



UGANDA PROTECTORATE

ANNUAL REPORT
OF THE
DEPARTMENT OF
AGRICULTURE

FOR THE PERIOD

1st April, 1946—31st March, 1947

PART II—EXPERIMENTAL

Published by Command of His Excellency the Governor

ENTEBBE

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INTRODUCTION

This Report is of necessity incomplete due to the retirement of the officers in charge of the sections of Plant Pathology, Agricultural Chemistry and Economic Botany, hence no reports are available from their respective sections. These omissions are regretted ; it is hoped that it will be possible to effect replacements at an early date and so to prevent a repetition of this unfortunate break in the work of the experimental and research stations of the Department. It will be appreciated that the investigational and experimental work undertaken by the Department on problems of land usage and farming systems including maintenance of fertility, on crops including the important work of cotton breeding, on control of insect and fungus pests and in fact on all problems connected with bringing about a better standard of farming, provides the fundamental knowledge on which the work of the Field Division of the Department is based. While the East African Agricultural and Forestry Research Organisation will in the future undoubtedly provide much needed assistance, there will still remain a vital need for a strong team of departmental specialists having that local knowledge and experience which is so necessary in dealing with agricultural problems.

The thanks of the Department are due to the Empire Cotton Growing Corporation for making available the services of Mr. H. L. Manning during the absence on leave of the Senior Botanist.

A. B. KILLICK,
Director of Agriculture.

REPORT OF THE SENIOR ENTOMOLOGIST

1. Advisory Work

All districts of the Protectorate, with the exception of Karamoja and Toro, were visited at least once during the year by members of the section.

A limited number of pests were submitted by Agricultural Officers and the general public. Advice was given on a wide variety of topics including *lantana* bug in gardens, pests of stored tobacco, control of biting ants in coffee plantations, preparation of honey, and storage of maize on estates.

The fumigation and certification of plant material for export has been continued—mainly, during the period under review, tree seeds for the Conservator of Forests.

In the absence of a Plant Pathologist, queries relating to plant diseases have been dealt with.

2. Locusts

In April, 1946, small immature swarms of the Desert Locust *Schistocerca gregaria*, invaded Uganda from east and south spreading over the whole Protectorate east of Longitude 31° East. There was a general movement northwards, and mature swarms were reported in a number of localities north of Latitude 1° North in May, with a small area of scattered hopper bands in North Busoga. Small mature swarms persisted until mid-June and two more areas of scattered hopper bands were located and destroyed in the centre of the Protectorate. There was no further locust activity except in September when two swarms from Kenya and one from the Sudan paid a brief visit to Karamoja before returning home.

The Red Locust *Nomadacris septemfasciata* was absent in the swarming phase during the year. Isolated individuals were found in open country in several localities in the Eastern Province. Unusual numbers of hoppers of the Acridid *Cataloipus oberthuri* Bol. appeared during June in two widely separated swamp areas, Northern Busoga and the Lake Albert Flats, giving rise to fears of a Red Locust invasion. The local inhabitants in the Busoga locality turned out and destroyed the hoppers.

A European locust scout was employed in Karamoja District and African scouts in Masaka, Ankole and Fort Portal Districts.

3. Cotton Pests

(a) *Cotton Capsids*.—*Lygus* spp., of which *L. vosseleri* (until recently recorded as *L. simonyi*) made up 95 per cent. of the total collections, were the predominant capsids on cotton at Kawanda. *Megacoelum apicale* was not plentiful, and showed no marked seasonal increase.

Seasonal population trends of *Lygus vosseleri* are shown in Table 1, which gives the average number of adults, and total adults plus nymphs, collected in one hundred sweeps of a standard net, at fortnightly intervals in fields sown in May, June, July and August. The May sown cotton was in a condition to attract capsids displaced from adjacent *Eleusine* harvested in July and August. The September–October peak population in the later sowings is believed to have arisen from the drying out of the wild hosts, including *Pseudarthria* sp., at that time. The general level of infestation of the Kawanda plots was low, and in Buganda as a whole even lower. The peak population was rather earlier than in 1945, but nearly three months later than that recorded in 1943. It tended to occur simultaneously over fields with sowing dates differing by as much as two months.

At Serere the capsid attack was comparatively light. Peak populations were recorded in August and again in early October. At the latter time 15 adults and nymphs per 100 sweeps were obtained in June sown cotton.

The recording of capsid damage to cotton foliage on a scale 0–10, as detailed in previous reports, was carried out over a large field at Kawanda used as a fertiliser trial. In spite of the mildness of the attack, the Senior Botanist was able to demonstrate that flower shedding was significantly related to the “capsid damage index” of the various plots. The mean index for the field was 3.29.

Exploratory trials were carried out at Kawanda on the control of capsids by D.D.T. with a view to providing the cotton breeders with undamaged plants. Owing to the low incidence of the pest on the station generally, and particularly on the May sown plots chosen for the trial, the results were inconclusive. There were indications, however, that weekly applications of Guesarol E.—a wettable powder containing five per cent. D.D.T.—at 40 lbs. per acre reduced the leaf damage and the shedding of buds and bolls from the five basal primary sympodia. Spraying at intervals of three weeks gave no results.

(b) *Bollworms*.—On Kawanda and in Buganda generally the damage resulting from bollworm attack was due mainly to *Argyroplote leucotreta*. Pink bollworm, *Platyedra gossypiella*, did not exceed ten per cent. of the bollworms in any sample and was frequently absent entirely. Spiny bollworm, *Earias* spp., was only occasional in mature bolls, but did early damage to tips and buds, particularly in the Eastern Province.

The main features of the *Argyroplote* infestation were the earliness of its appearance and the steady way in which numbers increased to keep pace with the increase in the number of bolls and so to maintain a steady proportionate loss of crop (Table 2).

(c) *Stainers*.—The estimation of stainer populations at Kawanda was based on the number collected each fortnight on fifty plants in plots chosen from those sown during each month from May to August. The results obtained are expressed as thousands per acre in Table 3,

together with the percentage of stained locules obtained in mature boll examinations on the same plots.

Dysdercus supersticiosus was the first to be observed on the cotton plots, but was replaced by *D. nigrofasciatus* by the time population counts were made and did not reach twenty per cent. of the population on any plot until January. *D. fasciatus* appeared in February but only in negligible numbers. Nymphs were present from December onwards, but only for a brief period in February were they really numerous.

In counting the number of locules stained in samples taken at Kawanda effort was made to separate those resulting from bacterial boll rot, *Bacterium malvacearum*, from stainer damage proper. From figures supplied by the Senior Botanist the percentage of the cotton picked over all the plots during successive months that was classed as stained (inclusive of boll rot) was December 22, January 29, February 16 and March 18. Of the whole crop picked 18 per cent. was stained.

At Serere, populations of *D. supersticiosus* and *D. nigrofasciatus* together reached 25,000 per acre on some plots during December and January. The highest figure at Kawanda was 8,400.

TABLE 1
AVERAGE NUMBER OF LYGUS VOSSELERI PER 100 SWEEPS

Period of examination			Month of Sowing							
			MAY		JUNE		JULY		AUGUST	
			adults	total	adults	total	adults	total	adults	total
July	1	..	0.3	0.3	..	..	..	..	..	..
	2	..	0.8	1.2	..	..	..	..	..	..
August	1	..	3.4	3.7	..	..	..	..	..	..
	2	..	2.8	3.3	2.0	2.0	..	..	..	..
September	1	..	2.1	3.9	4.9	8.6	2.4	2.4	..	..
	2	..	1.6	3.2	6.6	10.4	3.1	3.4	..	..
October	1	..	1.4	3.3	5.6	10.9	7.4	12.4	6.6	7.9
	2	..	0.9	2.5	2.4	6.0	4.1	11.0	3.4	6.4
November	1	..	0.6	1.2	1.5	2.9	2.4	5.9	1.8	5.6
	2	..	0.2	0.7	0.6	1.5	2.3	3.6	1.3	2.8

TABLE 2
PERCENTAGE OF LOCULES DAMAGED BY BOLLWORMS

Period of examination			Month of Sowing			
			MAY	JUNE	JULY	AUGUST
December	2	..	12	..	..	..
January	1	..	8	7	..	..
	2	..	8	10	1	..
February	1	..	8	10	12	6
	2	..	14	10	14	10
March	1	..	..	21	20	17
	2	..	..	..	3	2

TABLE 3

STAINERS (THOUSANDS PER ACRE) AND PERCENTAGE OF STAINED LOCULES

Period of examination			Month of Sowing							
			MAY		JUNE		JULY		AUGUST	
December	2	..	1.0	12%	0.0	..	0.0	..	..	..
January	1	..	1.3	31%	4.5	19%	1.8	19%	0.0	..
	2	..	1.3	27%	4.5	28%	1.8	19%	0.0	..
February	1	..	2.0	46%	5.1	14%	2.4	22%	0.3	16%
	2	..	8.4	50%	3.6	14%	2.4	32%	3.6	31%
March	1	..	..	..	6.9	21%	7.2	32%	3.9	26%
	..	..	..	..	8.4	41%	5.4	39%	8.4	22%

4. Coffee Pests

After a lapse of several years, detailed work on coffee pests has been started again. An extensive survey of the Mount Elgon area showed that *arabica* coffee there was attacked by *Antestia faceta*, *Stephanoderes hampei* and *Eucosma nereidopa* but, except for localized outbreaks of *Stephanoderes*, the general level of damage resulting from these pests was low.

Sampling of cherry on the Kawanda *robusta* coffee plots has been commenced with a view to developing a system of surveying *Stephanoderes* damage in Buganda, where this insect is the major pest.

Control of cutworms in coffee nurseries, and a study of outbreaks of *Metadrepiana* caterpillars have also been undertaken.

5. Grain Storage

Three aspects of the grain storage problem under consideration are: (a) maintenance of stocks of locally grown maize for the feeding of urban and industrial populations, (b) maintenance of adequate grain reserves in rural areas, and (c) prevention of insect damage to seed supplies on experimental stations and seed farms.

(a) maize growing for feeding labour on estates, in factories and in the main towns is a comparatively recent development arising from the growth of industrial undertakings, the influx of non-banana eating people into the towns and changes in food habits among the urban Baganda. The climate in the Lake Victoria coastal belt, where maize storage is required, is warm and moist throughout the year and necessitates great care being taken in ensuring that maize stocks are initially dry and that stores are systematically cleaned up before the new crop is brought in. These conditions have been observed on some estates where the carry-over of maize from one harvest to the next has been satisfactory. Generally, however, such conditions do not exist and deterioration after four months is considerable. Proposals have been made for bulk storage.

(b) grain reserves in rural areas outside the banana zone are based mainly on finger millet, *Eleusine coracana*, which is one of the grains most resistant to weevils. This aspect is rather more social than entomological.

(c) seed storage with mineral dusts to prevent weevil attack is being demonstrated with the assistance of Agricultural Officers. Diatomite, now in commercial production locally, is being used with, to a less extent, ground rock phosphate and some proprietary dusts. The construction of bins capable of being sealed after fumigation is being advocated for such rapidly damaged crops as beans (*Phaeseolus*) and quick maturing sorghums.

6. Termite Investigations

Two "graveyard" tests for resistance to termite attack of timber treated with various preparations of D.D.T. and Gammexane were started in August. The treated timbers were supplied by the Colonial Insecticides Research Team. The "graveyards" were arranged in the vicinity of colonies of *Bellicositermes natalensis* and *Pseudacanthotermes spiniger*.

A study has been started of the mound structure of *Bellicositermes natalensis* with the object of finding ways of destroying the colony and disposing of the mound material economically and to the best effect. These mounds are numerous in Buganda, somewhat conical in shape and from six to seven feet high, and offer a serious obstacle to such developments as intensive cultivation and the use of machinery.

An annotated list of 25 species of termites recorded from Uganda, including one new species, has been submitted for publication. Termites have been determined for workers in neighbouring countries including British Somaliland (*Proc. R. Ent. Soc. Lond.* (B) 15, 67-68).

Acknowledgments

It is a pleasure to record my appreciation of the assistance which I have received from all members of the Entomological Section, the Senior Botanist, the Senior Chemist and the Field Officers of the Department.

W. VICTOR HARRIS,
Senior Entomologist.

REPORT OF THE ACTING SENIOR BOTANIST

KAWANDA AREA

1. Introduction

During the absence, on long leave, of the Senior Botanist, the cotton breeding work and the food crops investigations were carried out by the writer. The greater part of the work was conducted at the Agricultural Research Station, Kawanda. It is emphasized, therefore, that any immediate conclusions apply to the surrounding area only, unless otherwise stated.

THE SEASON

The rainfall distribution differed from the normal expectation in that total precipitation for the early part of the year was much below average. This had the effect of delaying the planting of food crops, and in consequence, cotton planting throughout the Protectorate was generally late. The rainfall precipitation following the planting of food crops, though less in total than expectation, was so well distributed that food crop yields at this station were of a high order.

For the delayed cotton planting, rainfall was poorly distributed, and in addition, cool cloudy weather appeared to inhibit the development of the cotton plants. The effect of the climatic regime was most marked at the time of spraying for *Bacterium malvacearum*. Following a protracted fruiting period, unseasonably heavy rains at maturity from January to March, 1947, resulted in quite considerable crop losses, the greater part of which were due to boll rot. Yields were much below average.

METEOROLOGICAL

During the course of the season it became increasingly clear that the adverse effect, due to climatic regime, on the development of the cotton plant, was more marked than would be expected from a cursory examination of the rainfall and temperature normals. It is customary to plant cotton after the beginning of May. From the meteorological summary below (Table 1), it will be observed that during the months of June to August, the average temperatures and mean daily hours of sunshine are rather lower, for the period after planting, than are experienced in many cotton growing countries.

An attempt has been made to assess the net climatic effect by means of an appropriate index. It was considered, in this respect, that the accepted formulae for this purpose, did not give sufficient weight either to days without rain or, perhaps of equal importance, the prevailing cloudy days. Under conditions in this area, it has been observed that within five days of a reasonably satisfactory precipitation, quite severe wilting can take place. Further it would appear that these cool cloudy days simulate what may most conveniently be described as a "green-house" effect.

TABLE 1
SUMMARY OF METEOROLOGICAL DATA--KAWANDA

MONTH	RAINFALL				TEMPERATURE				SUNSHINE			
	11 Year Average		1946		Maximum		Minimum		3 years	1946		
	Inches	Days	"P"	Inches	Days	"P"	3 years	1946				
January	2.06	6.9	0.09	1.13	6	0.05	84.2	87.4	59.5	59.4	6.1	5.1
February	2.42	7.3	0.12	0.09	3	0.00	85.0	89.3	60.0	59.1	6.1	6.0
March	4.24	12.6	0.23	3.13	11	0.16	83.4	86.2	60.8	62.2	6.4	6.4
April	6.39	16.3	0.47	5.75	18	0.48	81.8	80.6	62.6	62.8	5.4	4.2
May	5.50	17.5	0.41	5.96	15	0.37	79.1	79.1	61.6	61.5	5.1	4.9
June	2.39	9.3	0.12	1.75	14	0.11	79.1	77.7	59.4	59.6	5.0	3.8
July	2.03	7.3	0.09	2.20	9	0.10	78.6	79.1	58.4	59.1	3.6	3.3
August	3.67	12.1	0.19	5.18	14	0.30	79.4	76.8	59.3	60.4	3.9	3.0
September	4.08	13.1	0.24	3.18	15	0.21	81.2	79.5	59.3	60.2	4.8	4.7
October	3.91	13.3	0.22	6.04	20	0.55	82.8	81.5	60.9	60.6	4.8	4.6
November	4.67	15.0	0.31	3.80	15	0.25	81.5	81.5	61.0	60.6	4.9	5.1
December	3.37	8.9	0.15	2.20	10	0.11	82.4	82.1	59.4	59.8	6.3	5.8
TOTAL	44.73			40.41	150		81.6	81.7	60.2	60.4		4.7
MEANS												

"P" The effective precipitation is evaluated as rainfall divided by days without rain during the period.

In a preliminary investigation of this nature, it seemed desirable to obtain the simplest index possible which was yet sufficiently sensitive to show differences likely to occur at this elevation (3,900'). Various modifications of the de Martonne formula were evaluated and were found to be unsatisfactory, since effective temperature variation at this altitude is not great. It was considered that mean daily hours of sunshine, as given by a Jordan Recorder, would be a more informative variate than temperature normals. The index finally chosen, a climatograph (after Ball-Taylor. See Uvarov, 1932), with effective precipitation and mean daily hours of sunshine, for the two axes, appears to illustrate most efficiently the differences known to exist. Since the number of days without rain in any month are considered to be of great importance, the monthly precipitation was evaluated as the rainfall divided by days without rain during the same period, and is given as "effective" precipitation.

Unfortunately over the 11-year period for which rainfall data are available, only three years' sunshine data were recorded. The climatographs for the means so derived, and for 1946, are given in the diagram below (Fig. 1).

It will be observed that, for this area, there are two fairly well defined dry seasons having 0.15", or less, of rain per dry day. One may be described as relatively hot and dry and the other, cool and dry. During the former but little growth takes place under the semi-arid conditions then prevailing; for the latter growth is inhibited both by reduced sunlight and low soil moisture. However, during this latter period, desiccation is not severe, so that established plants can survive and possibly extend their root systems more effectively than during the hot dry season.

2. Genetics and Breeding

(a) BLACKARM RESISTANCE

Extensive series of backcross material were grown, and included those from the 1st to 5th backcross on to BP 52, of the gene B_2 obtained from B 181 or a derivative. In addition two of the remaining backcrosses on to BP 52 of the B_3 gene from Gambia native, were grown.

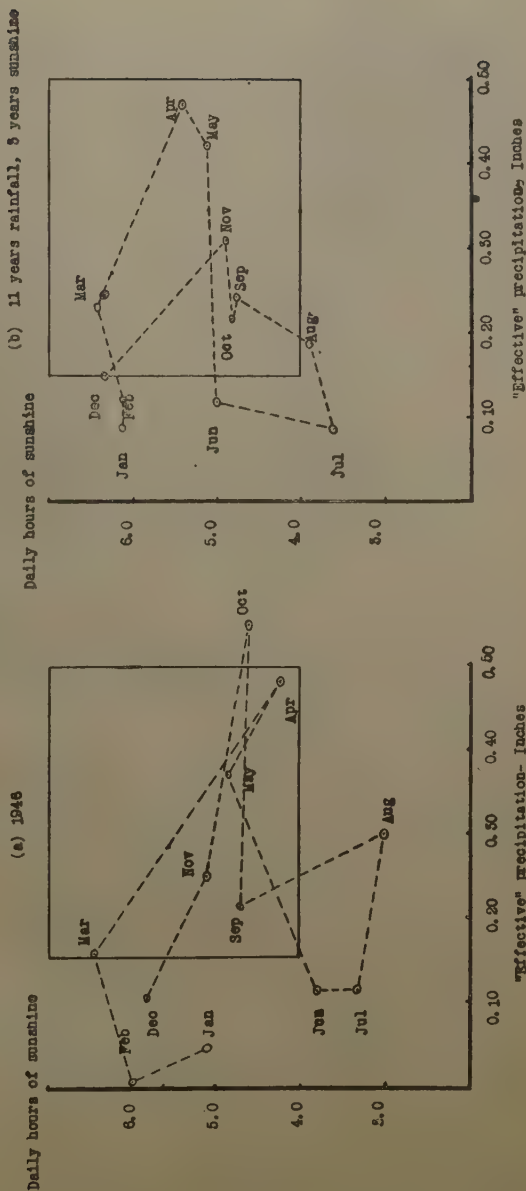
During the season Dr. R. L. Knight, visited the station at the time of the spraying operations. His subsequent report pointed out a serious disadvantage connected with the technique when conducted in this area. Under the climatic regime prevailing at the time (late July and early August) the Angular Leaf Spot phase of the *B. malvacearum* appeared to be inhibited. Reference to Figure 1, shows that from June, when the breeding material was planted, until late August extremely cloudy conditions prevailed. Dr. Knight has pointed out that the rapid development of Angular Leaf Spot requires sunny conditions in addition to minimum rainfall requirements.

Since the grading for resistance is of course based on the extent of the restriction of leaf spots, Dr. Knight has suggested for the present at least, that further work on gene transference at this station be

FIGURE 1

CLIMATOGRAPHS FOR 1946 AND THE 11 YEAR AVERAGES.

Where "Effective" precipitation is given as rainfall in inches divided by days without rain, and mean daily hours of sunshine is evaluated from a Jordan recorder.



suspended. It is possible that the limitations imposed on this work by climate in this area, do not obtain to the same extent at Serere.

(b) VERTICILLIUM WILT

F₂ progenies from 30 F₁ single plants selected in the previous season, were grown in an attempt to evaluate a possible mode of inheritance of resistance known to exist in the variety B 181. The susceptible variety BP 50 is of some importance in the north-eastern areas of the Protectorate. A chi-square test for a 3 : 1 hypothesis, on the basis of internal symptoms, indicated that there was no evidence to show that resistance to verticillium wilt is inherited as a simple Mendelian character. It should be pointed out, however, that the inoculation technique does not appear to be completely reliable. Some investigations are being conducted at Rothamsted and Barberton in this connection. It would appear that, before continuing this important work a more reliable procedure, the outcome of these investigations, should be adopted.

(c) OTHER GENETIC WORK

Various hybrids made during the previous season were carried a stage further as backcrosses. These included the transference of Okra leaf, tomentose hairs, naked and tufted seed, all to the BP 52 variety. When the precise contribution to crop losses, due to the more important insect pests, is known, much of this material might offer a valuable source of breeding material.

(d) MULTIPLICATION

One of the most important aspects of the breeding work is that of maintaining and improving the BP 52 strains. With this end in view many single plant selections were made by the Senior Botanist. Of these 149 were sent to Ukiriguru in 1945, for testing under conditions of relatively high Jassid infestation. Following the results there achieved, sixteen of the hairiest selections were planted at Kawanda and will form the nucleus of the best BP 52 strains. During the course of the following seasons these will be put through a "filter" system analogous to that which has been so successful in the West Indies and the Sudan.

Variable bulks were maintained of all of the more important strains. In addition single plant selections made from the commercial crop, were grown side by side with their various progenitors.

At the end of the season approximately 10,000 lbs. of high quality B/C 66 seed was released to the seed farm for multiplication. B/C 66 is a 3rd backcross to BP 52 and probably carries a fairly high degree of resistance to Blackarm. In Spinning Tests carried out by the Shirley Institute, the quality of this strain is at least as good as commercial BP 52.

(e) SPECIAL COTTON SURVEY

A special survey was conducted, during the early part of 1946, in which samples of seed cotton from the BP 52 and N 17 areas were analysed for differences due to fertility, placement on the plant,

localities and seed source. The comprehensiveness of the survey is indicated by the ginnery areas sampled, being 87 for the BP 52 area and 15 for the N 17 area. Amongst the several laboratory measurements carried out, it appears that lint per seed is that which under these conditions, was least affected by random variation. The lint samples were sent to the British Cotton Industry Research Association for small scale spinning tests. From the complete data so obtained, it was hoped to have some information regarding the most reliable of three possible sources of BP 52 seed, and also of the best general seed source for the N 17 area.

The laboratory analyses revealed large differences due both to locality and seed source. It was inferred from examination of these data that one of the most recent releases of BP 52 multiplication seed, which originated at the Research Station, Kawanda, was likely to be rather better than the others. Subsequent data for hair and spinning characters, the most reliable of which was the corrected Lea-count $\times$ strength product, substantiated these inferences. There were very large differences for all characters in the N 17 variety.

It is considered that the extensive seed movements which have since been proposed for the BP 52 areas will probably improve the uniformity of this high quality cotton (compared to other commercial Upland varieties). For the N 17 area specific recommendations are likely to be made in conjunction with the Empire Cotton Growing Corporation. There is some evidence that a general replacement of N 17 by BP 52 in certain areas would not lead to a material improvement in yield or possibly even quality. In addition the high incidence of *Bacterium malvacearum* in the areas of the north-east with more sunny conditions coupled with higher rainfall, suggests that such a replacement by existing strains of BP 52 might prove rather unsuitable.

The continued interest and promptness of handling by the Shirley Institute of such a large number of samples, has contributed in no small degree to the value of the survey. Much valuable information regarding hair and spinning characters of the commercial crop is now available.

3. Agronomy

(a) SOWING DATE TRIALS

Food crops are usually planted in the cotton growing areas of Uganda with the first rains beginning at the end of February; cotton is planted during or after the harvest period of these. Should the planting of food crops be delayed, almost invariably the cotton is planted "late". With such a system it is very desirable to know the latest planting date from which reasonably high cotton yields may be expected. The importance of this problem may be gauged by the value of the cotton crop to the cash economy of the Protectorate. Since it is not the invariable rule to plant cotton on the identical land used for planting of food crops, there is some latitude allowable in the matter of time of planting of cotton. Further in certain areas cotton is planted

on newly opened land prior to the planting of grain crops in the following year.

Field experiments conducted over a number of years have shown generally that the earliest sowings of cotton have consistently out-yielded later plantings. Departmental propaganda was therefore directed towards encouraging early planting of cotton. In recent years some doubt has been expressed regarding the validity of the inferences from the early experiments. One of the possible criticisms has been that regarding the likely "build-up" of insect populations, notably *Lygus* sp., which could migrate from the early to later plantings in a contiguous experimental area.

In designing an efficient experiment to investigate further the optimum time of planting in relation to crop losses due to insect populations, there are several important considerations. It was accepted for Buganda, at least, that planting of cotton for dates earlier than mid-May would have but little practical application. Again with isolated plots which might avoid this "build-up" of insect populations, locality differences could likely be of greater magnitude than differences due to planting dates. To overcome this latter disadvantage a "staggered" time of planting design based on one put forward by Empire Cotton Growing Corporation Officers in Nyasaland was amplified to include ten fortnightly planting dates spread in groups of three, over eight localities. The spatial isolation on an experiment station of this size was not great, but was considered to be adequate. The continuity between planting dates was maintained by having a two-thirds overlap in time. For convenience the layout (omitting the four replications of each treatment at every locality is presented diagrammatically below.

It will be observed that where the "build-up" of insect populations is likely to be a major contributory factor in crop loss, any one sowing date X would likely yield less than Xa, and this in turn less than Xb for planting dates from May 29th to August 7th. These latter represent the general range for commercial planting in this area.

With the analysis of the early design of this type, the relatively large differences between localities tended to obscure those which may have existed between sowing dates. Further the error term chosen was so inefficient that all but the very largest differences would be considered to be no greater than could have occurred by chance. For this newer design, therefore, it was considered desirable to adjust treatment means for the localities in which they occurred.

The writer is deeply indebted to Dr. R. L. Anderson of the Institute of Statistics of the University of North Carolina, for providing a scheme of analysis whereby treatments are adjusted for locality difference from the identity $A_i \times c_{ij}$. Here the c -multipliers were derived from a least squares solution and the A_i values are indicated on the diagram above. With this analysis the Treatment $\times$ Locality interaction provides an estimate of the extent to which treatment yields differ

DIAGRAM 1

COTTON SOILING DATE EXPERIMENT, KAWANDA 1946-47.

Basic design for the three date plan. Four replications (not shown) at each locality.

LOCALITY	PLANTING DATES [TREATMENTS]									
	1 MAY	15 MAY	29 MAY	12 JUN	26 JUN	10 JUL	24 JUL	7 AUG	21 AUG	4 SEP
1	1	2	3							
2		2 _a	3 _a	4						
3			3 _b	4 _a	5					
4				4 _b	5 _a	6				
5					5 _b	6 _a	7			
6						6 _b	7 _a	8		
7							7 _b	8 _a	9	
8								8 _b	9 _a	10

* SEE TEXT FOR c_{ij}

TREATMENTS ADJUSTED FOR LOCALITIES FROM THE IDENTITY $A_i \times c_{ij}$
A_i VALUES
$A_1 = 3T_1 - L_1$
$A_2 = 3T_2 - L_1 - L_2$
$A_3 = 3T_3 - L_1 - L_2 - L_3$
$A_4 = 3T_4 - L_2 - L_3 - L_4$
$A_5 = 3T_5 - L_3 - L_4 - L_5$
$A_6 = 3T_6 - L_4 - L_5 - L_6$
$A_7 = 3T_7 - L_5 - L_6 - L_7$
$A_8 = 3T_8 - L_6 - L_7 - L_8$
$A_9 = 3T_9 - L_7 - L_8$
$A_{10} = 3T_{10} - L_8$

at different localities. That is in the absence of a large and significant interaction, it would be concluded that there were no real differences in cropping capacity for the same treatment at different localities. Since the methodology might be of interest to other workers on the same problem, it is proposed to publish full details elsewhere.

Two such Sowing Date Trials were laid out during the season, one at the Kawanda Research Station and the other in Masaka. The site chosen in Masaka represents an area where rainfall at all times is uncertain, but the expectation is probably greatest for the second half of the year. Since this trial was not begun until September of 1946 the final yields are not yet available. This report deals only with the trial conducted at Kawanda.

That cotton plants suffer characteristic physiological disturbances due to certain climatic conditions is well known. Some attempt to relate growth and maturity to climatic conditions was therefore made. It is proposed to consider data from the Sowing Date Trial and in the later discussion relate these to optimum time of planting on the basis of these and additional data available from a series of independent trials at various planting dates.

Summarized data for number of days to first flower, leaf damage per plant as a measure of capsid attack, plant height at 154 days and seed cotton in pounds at the rate, all adjusted for locality differences, are given in the Table below.

TABLE 2
SUMMARY OF DATA FROM THE SOWING DATE EXPERIMENT, KAWANDA,
1946-47

ALL TREATMENTS ADJUSTED FOR LOCALITIES

Treatment	Number of days to first flower	Leaf Damage per plant at 126 days	Plant Height in ins. at 156 days	Seed Cotton per plot lbs. per acre
1=May 1 ..	99.1	4.5	39.0	803
2=May 15 ..	101.8	4.2	38.9	828
3=May 29 ..	102.6	4.7	40.4	776
4=June 12 ..	99.4	2.7	40.0	741
5=June 26 ..	104.2	2.6	37.5	617
6=July 10 ..	99.1	2.7	41.9	622
7=July 24 ..	98.8	1.4	40.5	533
8=August 7 ..	93.2	1.0	38.2	422
9=August 21 ..	90.6	0.2	36.2	295
10=September 4 ..	95.3	(0)*	32.6	196
	Significance	of Differences	(p)	
Localities (Adjusted) ..	0.01	0.001	0.001	Very small
Treatment (Adjusted) ..	0.01	0.001	0.01	0.001
Interaction (T-L) ..	0.01	N.S.	N.S.	N.S.

* The net effect was evaluated as a negligible negative value.

As might be expected with such a comprehensive trial with planting dates spread over four months, and all at specific dates, germination was not uniformly good. However, with the exception of the planting on June 26th, the stand was good for all other treatments. Reference to Figure 1 for the climatic regime then prevailing, shows that conditions were poor for the relevant periods (*i.e.*, 10th July and 24th July). Later development as reflected in plant height was not good. The sowing on the 10th July though slow in germinating did not suffer to the same extent. Differences in number of days to first flower show a fairly well marked trend, with the exception of the June 26th planting, becoming first later, and followed, as hours of sunshine per day increased, by a material reduction in days to first flower. The node number, not included in the summary, showed but little variation between sowing dates. The interaction between treatment and locality showed that there were real differences between the same treatments at different localities. In general it was observed that X flowered before Xa and this before Xb, at any planting date.

Capsid damage counts were made at 126 days for each treatment. The procedure, evolved by the Entomological Section, was as follows:—The five most mature leaves immediately below the growing point are examined for damage on an arbitrary scale 0 to 5. For this experiment planted at a spacing of 3'×1' with two plants per hole of which 45 plants in each plot were examined, a fairly representative estimate of capsid damage was obtained. The actual dates of observation were in fortnightly intervals commencing September 4th. From examination of the lower diagram in Figure 2 below it will be observed that leaf damage showed a downward trend from the earliest to the latest planting date.

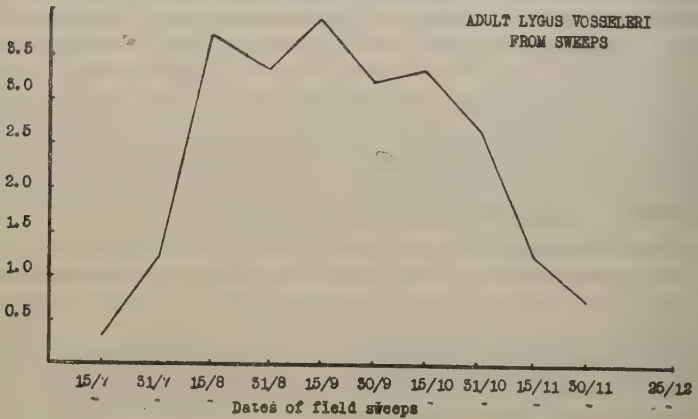
That leaf damage counts do in fact indicate the presence of *Lygus* sp., is suggested by the fairly close parallel with separate estimates of *Lygus vosseleri* made by the Entomological Section from their sweep technique. Mean populations of adult *Lygus* are given in the upper diagram in Figure 2.

There was no indication between locality and treatment for capsid damage indicating that there was no "build-up" of *Lygus* from early to late plantings at localities. On further examination of these data rather the opposite effect was indicated, that is the earliest treatment at any one locality appeared to have the highest damage counts. Since in a separate experiment, with a large number of plots at one locality, there was a significant correlation between "flowering" and capsid damage ($r = +0.43$; $n = 95$), the interaction between treatment and locality for days to first flower for the sowing date experiment might be explained on this basis. That is for "flowering", the Xb's which tended to be later, had the higher capsid damage counts, presumably due to early bud shedding.

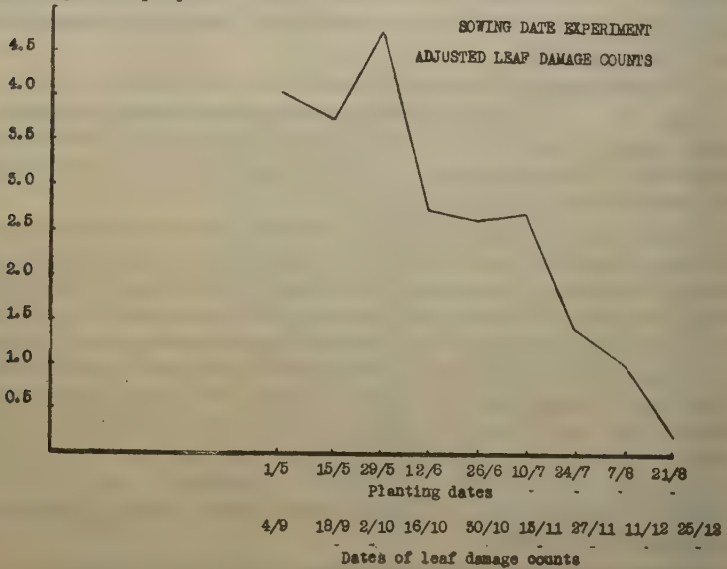
Plant height also showed the same sort of trend as days to first flower with the greatest main stem elongation occurring with the least

FIGURE 2

COTTON SOWING DATE EXPERIMENT, KATANDA. 1946-47.

Comparison of captured *Lygus vosseleri* from 100 sweep counts
and adjusted leaf damage counts.Adult *Lygus* per sweep

Leaf damage count per plant



favourable climatic cumulative means, when a cool cloudy climatic regime prevailed.

Differences observed for these plant and other measurements were not reflected in the final adjusted yield data. That capsid as measured by leaf damage must certainly contribute to crop losses may be inferred from the relationship with early shedding. However a comparison between the capsid damage count (given in Figure 2) and the adjusted yield data (shown in Figure 3 below) shows that yield levels were extremely low for the lowest levels of capsid attack.

FIGURE 3

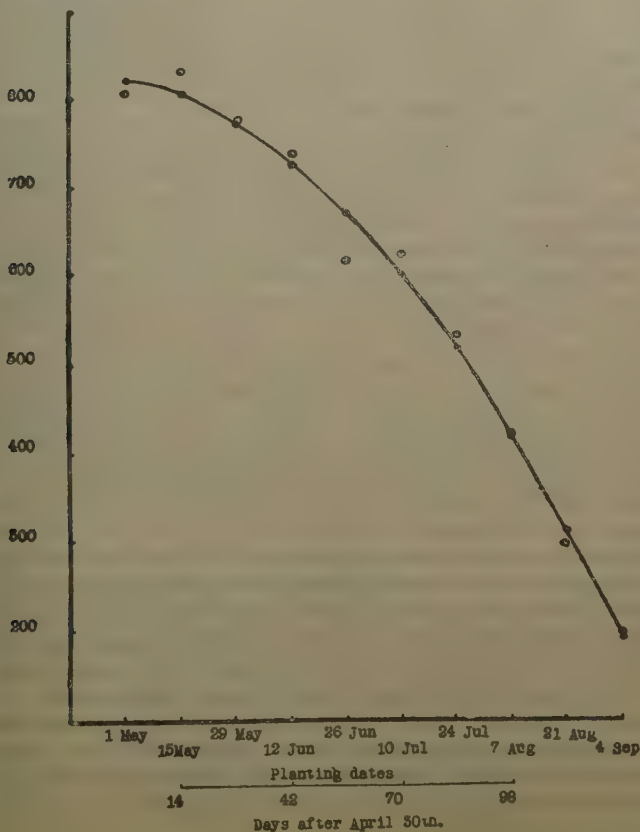
COTTON SOWING DATE EXPERIMENT, KAWANDA, 1946-47.

Adjusted mean yields from Sowing Dates. Seed cotton lb. per acre.

○ ADJUSTED VALUES.

Theoretical curve from a second degree polynomial.

Seed cotton per acre. lb.



It is clear that factors other than Capsid, though possibly of equal importance, have contributed to the extensive crop losses known to exist. There were some indications which, as judged by the magnitude of the interaction between treatment and locality, could not be considered to be significant, that insects other than capsid may have contributed to the crop losses of these later plantings. Undoubtedly the heavy rains during maturity were amongst the more important factors.

SUMMARY OF THE SOWING DATE TRIAL

On the basis of this trial conducted during one season, it must be concluded that of many possible contributory factors to crop loss, an unfavourable climatic regime is by no means the least important. Undoubtedly the relative importance of *Lygus* sp., and probably *B. malvacearum*, when sunshine is more intensive must also be great. The lack of a significant interaction between treatment and locality shows that while insect pests other than *Lygus* may have contributed to crop loss, there could have been no migration of great magnitude from early planted to later planted plots in any one locality. There was some evidence that while "bolting" was a feature common to all planting dates under review, the very earliest and the very latest sowings tended to grow more efficiently; that is the yield in relation to excessive vegetative growth, tended to be higher.

Much of the success of the earliest planted cotton is attributed to the fact that it was established prior to the onset of the cool dry season. Further, though no root system studies were attempted, it is probable that root penetration would be greater than for plants established during higher rainfall conditions. As a result then, when the "late" rains commenced, early planted cotton was less liable to physiological shedding such as was recorded for the later plantings. Since the period from planting to final picking of cotton under these climatic conditions is as long as 300 and not less than 240 days, it is not surprising that the very late plantings were unsuccessful. From the available evidence, it would appear that the earliest possible planting dates under discussion and under similar conditions of climate, insect and pest attack, as were experienced during this past season, were likely to lead to the highest yields for this area.

OPTIMUM TIME OF PLANTING

Reference has been made previously to the characteristic physiological disturbances of the cotton plant under certain climatic conditions. In some cotton growing countries the term "bolt" has been adopted to describe this phenomenon. The effect which is expressed as main stem elongation, is most pronounced where heavy rains occur before the onset of the reproductive phase (Hardy, 1946). It has been observed in Uganda that cotton plants in some areas, at certain seasons, develop the growth habit variously referred to as "Uganda habit" or "columnar" (Jameson, 1946). That climatic regime may contribute largely towards this growth habit in Uganda, has been suggested by data from the

sowing date trial above. It is reasonably certain that capsid attack and blackarm disease contribute largely as a result of the bud and boll shedding they cause. Undoubtedly one of the more immediate problems is to estimate the relative contribution to crop loss of each of these several factors before attempting remedial measures. The difficult nature of the problem is partially demonstrated by the fact that under certain conditions in Uganda, crop losses due to *B. malvacearum*, even from strains of cotton homozygous for the resistant gene B_2 , appear to be quite considerable. Again complete experimental control of capsid has not yet been secured, so that its independent effect has still to be estimated.

Accepting the fact then that these factors will continue to operate for some time to come, from the purely practical aspect it becomes necessary to ascertain the optimum time of planting while these factors continue to operate. With late maturing varieties such as BP 52, it may be inferred from the sowing date trial at Kawanda, that the earliest planting date after May 15th, is likely to lead to the highest yield for this area given a similar climatic regime. Reference to the climatograph in Figure 1b shows that such a climatic regime with the characteristic dry months of June and July, follows the normal expectation. That the adjusted data from the sowing date trials do in fact measure the average effect on a larger scale is demonstrated by the yields from the 24 acres of multiplication grown on the Experiment Station. Thus the average planting date for Kawanda was about July 1st. The weighted average yield per acre was just over 600 lbs. of seed cotton per acre. From Figure 3 it will be observed that such would in fact have been expected on the basis of the sowing date trial.

To widen the basis for inference, however, it seemed appropriate to examine available data over a number of years. Differences due to climatic regime would then more easily be apparent. For this purpose District Variety Trial data over the 9-year period 1938-46 were collated. A correlation surface was prepared for one of the two varieties common to all trials, namely B 181, and is shown below (Fig. 4).

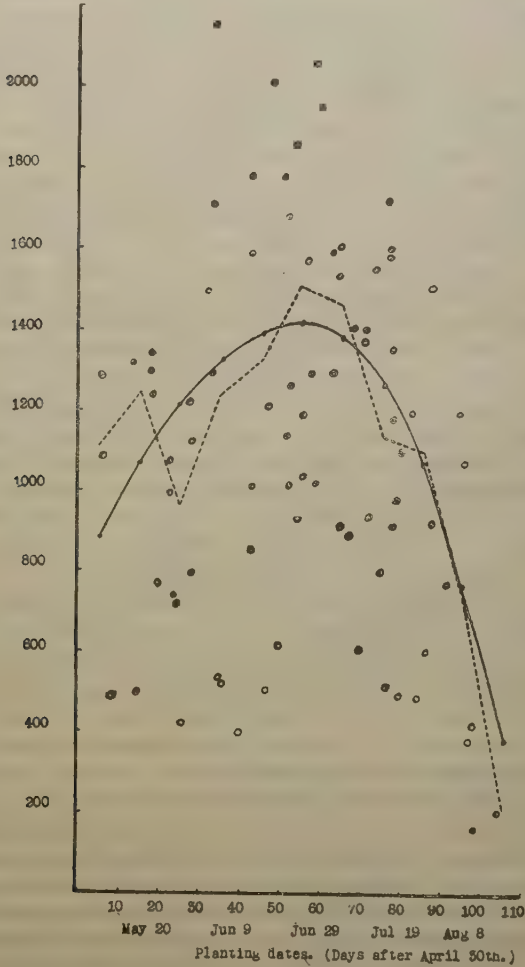
To facilitate the interpretation of these data the theoretical points are given by a third degree polynomial of the form $3.4101 + 0.9932 X + 0.0206 X^2 - 0.0075 X^3$ which was evaluated from a least squares solution. The very general geographical nature of these data is indicated by the range of localities: from Masaka in the south of Buganda to Bulemezi in the north-east; in addition areas in the western part of Buganda such as Bukomero and Kakumiro are included. The climatic regime prevailing over such widely scattered localities is often quite markedly different. Thus in parts of Bulemezi and near the Lake shore in Masaka, the Lake climate (Henderson, 1945) prevails. The characteristic feature of this climatic regime is a less well marked dry period during June and July. This applies also to other areas in the north-east which are not under discussion in this report. For other areas of which Kawanda is representative, a dry period in June and July is equally characteristic. For this area the

FIGURE 4

CORRELATION SURFACE SHOWING THE RELATIONSHIP BETWEEN YIELD AND
PLANTING DATE OF B 181 IN VARIETY TRIALS, 1938-46.

- Experimental points
 ---- Means for yield arrays
 — Theoretical curve from $3.4101 + 0.0952 X - 0.0203 X^2 - 0.0005 X^3$

Seed cotton per acre, lb.



late rains though often greater in total quantity are less reliable, and tend to fall in fewer but greater precipitations.

That there is quite a considerable variation between yield and planting date is demonstrable. The theoretical curvilinear relationship then is little more than an average effect. However, one inference may be drawn with some certainty, namely that for these trials very late plantings have been uniformly unsuccessful. The success of those trials during the middle of June may be explained by the fact that trials grown, where the Lake climate prevails, can be established during June. Planting dates up to the end of June can be, and often are, successful in many parts of Buganda. However, it should be noted that all Uganda varieties are late maturing (under Kawanda conditions from planting to final picking often covers a period of 300 days). Much of the failure due to late plantings then may be ascribed to uncertain late rains, or as was experienced during this past season in most districts, heavy rains just prior to maturity. It is clear then that considerably greater crop risks are involved with later plantings. At the same time it is possible that quicker maturing varieties may be evolved for a planting date, after the cool dry season and which might avoid the greater part of the capsid attack. Until such time, however, it would appear that early plantings, under existing conditions, have the greatest expectations of reasonably high yields. Where the June-July dry period is less severe, there is some latitude allowable, but it should be noted that even in these areas a very late (after the end of July) planting period has not been uniformly successful.

(b) DISTRICT VARIETY TRIALS

District Variety Trials were conducted at 11 centres in Buganda during the 1946-47 season. The individual 5×5 latin squares were analysed separately and collectively as a serial experiment. The statistical reduction of these data, for the serial experiment only, are given in the table below.

TABLE 3
DISTRICT VARIETY TRIALS 1946-47

11 LOCALITIES EACH WITH 5×5 LATIN SQUARE PLANTING DATES FROM 15TH JULY TO 13TH AUGUST ANALYSIS OF VARIANCE AS A SERIAL EXPERIMENT						
Due to		d.f.	S.S.	M.S.	F	p
Row	.. ..	44	808.86	..	..	..
Columns	.. ..	44	605.26	..	..	..
Varieties :						
MU8A, B181 and BP52 Vrs.						
BAR 7/1 and Buganda Local		1	150.42	150.42	63.20	V.S.
MU8A and B181 Vrs. BP52		1	13.00	13.00	5.46	0.05*
MU8A Vrs. B181 ..		1	5.02	5.02	2.11	N.S.
BAR 7/1 Vrs. Buganda Local		1	1.58	..	..	..
Localities	.. ..	10	11,180.74	1,118.07	469.78	V.S.
Localities $\times$ Varieties	.. ..	40	455.83	11.37	4.78	0.001
Error	.. ..	132	314.75	2.38	..	..
TOTAL		274	13,535.46	..	..	..

C.V.=14.7% General Mean at the Rate of 706 lbs. per acre.

Table 3—*continued*

SIGNIFICANCE OF DIFFERENCES BETWEEN VARIETY MEANS

YIELD OF SEED COTTON LBS. PER ACRE				
MU8A	B181	BP52	BAR 7/1	Buganda Local
773	745	720	654	639

YIELD LEVEL OF LOCALITIES LBS. PER ACRE

Kalagala	Bukalasa	Nakifuma	Kyanamu- kaka	Mukono	Kawanda	Kakumiro	Bukomero	Kabasanda	Bulindi	Nkozi
1,538	1,338	1,110	811	600	551	524	470	325	253	250

It will be observed that all but a few of the locality yield levels were of a low order and variety mean yields were all low. This was a reflection of the general cropping conditions throughout all areas. Much of the differences ascribed to variety means is due to the orthogonal comparison MU8A, B 181 and BP 52 *versus* BAR 7/1 and Buganda local. Of the remaining orthogonal comparisons, MU8A and B 181 differed significantly from BP 52 but not from each other, neither was the difference between BAR 7/1 and Buganda local significant at the $p=0.05$ level. Since the locality $\times$ variety interaction was highly significant it is probable that varietal differences generally should be interpreted with caution.

As might be expected with the wide range of soil and climatic conditions over such a large area, differences between localities were highly significant. Perhaps the most important aspect of the serial analyses is the highly significant variety $\times$ locality interaction, which confirmed that of the previous season. As the more appropriate error term, there was in consequence a reduction in the level of significance of differences between variety means. Thus while the main comparison differed significantly from the remainder, the significance of the differences between MU8A and B 181 *versus* BP 52 were probably no greater than could have occurred by chance.

From the point of view of varietal suitability under a wide range of environmental conditions, the variety $\times$ locality interaction is of fundamental importance. To investigate this more fully, these data from ten centres for most of the nine seasons 1938–46 were examined in some detail. During the period the range of cropping capacity for locality means was from 750 to 1,450 lbs. seed cotton per acre. Further the ten centres chosen provide a fairly representative sample of the main cotton growing areas of Buganda. It should be noted that Kawanda with but few years data was omitted because experimental planting dates, both very early and very late, have been outside of the range of the remaining ten centres.

Only BP 52 and B 181 were grown in all trials so that any later deductions must necessarily apply to these varieties. In studies of this nature one of the most efficient methods for studying the relation between general fertility and varietal differences, is that of using the artifice of the regression of mean yield on the difference of one variety from the mean of the others. By using the regression of variety on locality an equivalent effect has been carried out. Two regression equations were evaluated for BP 52 and B 181. The resulting data showing both the experimental points and the theoretical linear relationship, based on 9-year means, are presented diagrammatically below (Fig. 5).

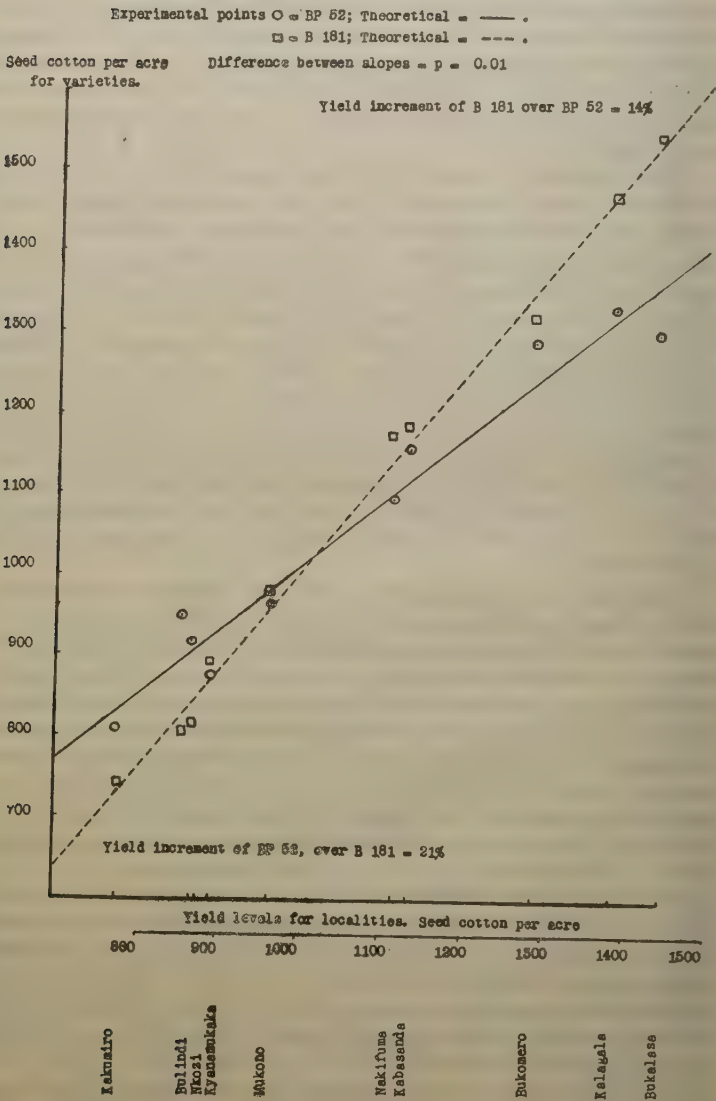
The analysis of variance of these regression data revealed some extremely valuable information. Thus while differences between variety means over the 9-year period were negligible, differences between slopes were highly significant. That is the differences in cropping capacity under varying levels of fertility, for the two varieties, is most marked. Under relatively high fertility conditions B 181 out-yields BP 52 by as much as 14 per cent., whereas under relatively low fertility conditions the difference in favour of BP 52 is as high as 21 per cent. Further examination of the data which gave rise to these varietal means shows that at the four centres of lowest fertility, in 24 out of 30 trials BP 52 out-yielded B 181. At the three centres of highest fertility in 20 out of 26 comparisons, B 181 out-yielded BP 52. For the remaining centres as might be expected from the regression pattern there was considerable variation, though in 12/18 trials B 181 out-yielded BP 52.

The high cropping capacity of B 181 under conditions of high fertility such as Bukalasa, where the strain was evolved, is not unexpected. BP 52 also was selected at Bukalasa but much of the subsequent selection has been conducted over a wider range of conditions. In addition it has rather fewer but larger bolls. The relatively poor performance of B 181 under the lower fertility conditions is, however, of some importance in formulating the most effective breeding policy. It is possible to make the generalization that growth and cultural conditions throughout the cotton growing areas are rather less suitable than those which obtain at Experiment Stations. Therefore, while B 181 has been shown by its yield performance to be the best strain on Experiment Stations, it appears now possible to explain its often disappointing performance under the more general field conditions. The yield synthesis of B 181 appears to depend largely on the development of a large number of relatively small bolls. Since in addition it is rather late maturing even amongst Uganda varieties, it is not surprising that it requires high fertility conditions for a maximum expression of yield.

It is clear that a further examination of a large range of varietal types must be conducted and these under the widest possible range of soil and climatic conditions. It is possible that a variety with rather fewer but larger bolls might be more successful under general cultivation

FIGURE 5

REGRESSION OF VARIETY YIELDS ON LOCALITIES FROM VARIETY TRIALS 1938-46.



than B 181. In this connection BP 52 has a slightly larger boll than B 181 and BP 50 rather larger than BP 52. The inferences from District Variety Trials would suggest the general direction towards which the breeding policy at the major Experiment Stations should be aimed. For this reason the relationship between these trials and breeding work is now stressed. For the coming season an intensive study will include fullest possible details regarding previous cropping history and incidence of insect pests and diseases. In the meantime there appears to be no advantage in favour of the B 181 type over BP 52 apart from its resistance to *B. malvacearum*, except under relatively high fertility conditions.

(c) FERTILIZER TRIALS

The opening of extensive rock phosphate deposits at Tororo in the Eastern Province and the possibility of obtaining comparatively cheap nitrogenous fertilizers in the future, were amongst the main reasons which led to the inauguration of a new series of fertilizer trials in Uganda. The ever existing need for increased production per unit area of cultivable land, and more particularly from land cultivated continuously, was an equally important incentive.

In designing this series of experiments in conjunction with the Chemical Section, consideration had of necessity to be given to existing sources of fertilizer. In addition the comprehensiveness was limited by facilities for the conduct of these trials. The basic question to be answered in these preliminary investigations was the likely extent to which yields could be increased, with added inorganic fertilizers, from land in various stages of cultivation following opening. Special attention was devoted to phosphate responses. At this stage no great importance was attached to the specific source of plant nutrient. Rock and silico-phosphate, sulphate of ammonia and sulphate of potash were used throughout.

1. Experimental Results

The field staff, which is at present much below the established strength, made it clear that modern comprehensive factorial experiments involving a large number of plots, were beyond the scope of their facilities. It was agreed therefore, that these larger experiments should be conducted only at the Kawanda Research Station and the Experiment Stations at Serere and Ngetta. Further it was assumed on the basis of information supplied, though perhaps with but little justification, that phosphate responses were likely to be of greater magnitude in the presence of nitrogen. Preliminary trials with *Eleusine* in the Eastern Province showed that both rock and silico-phosphate led to yield increments. The average effect due to phosphates was of the order of 13 per cent. There was some evidence that the double dressing of rock phosphate was as good as the single dressing of silico-phosphate, both applied at or soon after planting. There was a slightly depressing effect with the double dressing of silico-phosphate which was not however significant at the $p=0.05$ level. Since there was no significant

nitrogen $\times$ phosphate interaction it is probable that the independent effect due to nitrogen was of the order of 40 per cent.

Factorial experiments involving all combinations of nitrogen, phosphate and potash, were grown with cotton at Kawanda, Serere and Ngetta. The well known $3 \times 3 \times 3$ designs due to Yates, were laid out at each centre and in addition, at Kawanda one which involved three varieties at two levels each of nitrogen phosphate and potash. The necessary corrections were made for estimating the variance due to the appropriate two and three factor interactions. Other experiments, of a similar high standard, included two $3 \times 3 \times 2$ designs (Nitrogen Phosphate and Variety) with groundnuts, one at Kawanda and the other at Serere. In addition 3×3 designs with nitrogen and silico-phosphate were laid out at a number of centres in the Eastern Province with *Eleusine*, and in Buganda with Maize. These latter were so arranged as to be capable of alternative analysis as randomized complete block designs.

A summary of the more important features of some of these experiments with cotton and groundnuts is given in Table 4.

Since these data must provide the basis for future experiments, it will be more convenient to discuss them by centres, each of which represents a distinctive area.

KAWANDA

The two fertilizer trials with cotton were conducted on land in the second year of cultivation after a three-year rest under Elephant Grass. The 3×2^3 design was planted early (May 28th) and the 3^3 design late (July 22nd). It has been recorded, in other cotton growing countries, that substantial accumulations of soil nitrates are built up during dry periods of intensity similar to those experienced in this country. The object of these two planting dates, was to investigate the possible differences in response to added inorganic nitrogen. For these trials, with a normal climatic expectation, it might have been upposed—were such an hypothesis correct—that responses of the later planted trial would be of greater magnitude.

Taking yield as a criterion, it is shown that only those differences due to varieties may be regarded as greater than random chance. There was, however, some evidence from the early planted trial, that yields for all varieties were depressed by nitrogen, and that BP 52 gave positive yield responses to phosphate and potash. It should be noted that the fertilizers were applied six weeks after planting. For the 3^3 design, which was planted late, when it might be expected that some leaching would have taken place, early growth was poor. In addition heavy rains occurred both before and during fruiting. Analyses of variance for "flowering" and plant height showed significantly favourable responses to nitrogen. A significant nitrogen-potash interaction for "flowering", also, was recorded. The analysis of variance for leaf damage due to *Capsid* sp. attack, showed that over

TABLE 4
SUMMARY OF SOME FERTILIZER TRIALS 1946-47.

CROP		COTTON			GROUNDNUTS		
PROVINCE		BUGANDA	EASTERN	NORTHERN	BUGANDA	EASTERN	
Locality	..	Kawanda	Serere	Ngetta	Kawanda	Serere	
Design	..	3 ³	3 ³	3 ³	3 ² × 2	3 ² × 2	
Treatments	..	0, 1 and 2 cwt. Sulphate of Ammonia 0 and 2 cwt. Sulp. of Am. 0 and 2 cwt. Silico-Phos. 0 and 2 cwt. Sulp. of Potash	0, 1 and 2 cwt. Sulphate of Ammonia 0, 1 and 2 cwt. Silico-Phosphate 0, 1 and 2 cwt. Sulphate of Potash		0, 1 and 2 cwt. Sulphate of Ammonia 0, 1 and 2 cwt. Silico-Phosphate 2 Varieties		
Varieties	..	B 181, BP 52, BP 50	BP 50	N 17	B 227 and	B 239	
Year of Cultivation after Grass Ley	..	2	(1)	3	3	2	
Planted	..	May 28th	June 26th	June 27th	14th March	24th March	
Time Fertilizer application	..	6 weeks after planting	2 weeks after planting	Before planting	At flowering 4 weeks after planting	4 weeks after planting	
Number of Plots	..	72	54	54	72	72	
Spacing	..	4' × 2'	3' × 1'	3' × 1'	1' × 1'	1' × 1'	
Plot Size	..	1/110 ac.	1/72 ac.	1/71 ac.	1/84 ac.	1/84 ac.	
General Mean lb./acre	..	862	852	1,581	2,600	2,130	
Conclusions	..	Yield of B 181 and BP 50 BP 52 p = 0.0 No Sign. Responses to fertilizer	Significant Yield Increments due to N = 18.5% ; P = 13.1%	Significant Yield Increment due to N = 9.1%	Yield of B 239 B227 Quadratic Phosphate Response Significant P = 0.01. P ₁ = 16%	Quadratic Nitrogen Response Significant N ₁ = 16%	

the range of variation due to treatment differences, there were no significant differences other than a reduction, due to certain levels of nitrogen in combination with potash. The treatment differences indicated by these early analyses were not reflected in yield differences, between which there was no significance, other than a linear depressing effect due to silico-phosphate. There were no obvious responses to the main effect of potash. For this trial all fertilizers were applied localized beneath the seeds before planting. Dwarf beans were grown as an indicator crop to evaluate the residual effects from the 3³ experiment, and yield differences were small and in no instance significant at $p=0.05$.

While the yield level for the early planted trial, at a spacing of $4' \times 2'$, was well above the 600 lbs. per acre average for the Experiment Station, that for the late planted trial at a spacing of $3' \times 1'$ was low. It is probable that excessive rains both during fruiting and at maturity, contributed largely to extensive crop losses observed.

The experiment conducted with groundnuts consisted of three levels each of nitrogen and silico-phosphate, with two varieties. The varieties chosen have rather different yield syntheses, B 239 having a large number of small nuts, and B 227 having rather fewer but larger nuts. It was hoped to derive some information regarding possible variety $\times$ fertilizer interactions. With land in its third year of cultivation, and the fertilizers applied at flowering in rows which were covered, a significant yield increment due to silico-phosphate was obtained. It should be noted that the quadratic term was highly significant, the single dressing being 16 per cent. greater than no phosphate, but the double dressing was only 2 per cent. better. Differences due to nitrogen were small, and while differences between varieties were significant, there was no significant variety $\times$ treatment interactions. Average yields due to P_0 (based on 24 plots) were 2,450 lbs. per acre of dry nuts and P_1 from the same number of plots, 2,850 lbs. per acre. The rainfall during the 120-day period from planting to reaping, was just over 17".

SERERE

The cropping history of the area chosen for cotton at Serere is such that no well defined period of grass cover may be said to have existed. Following a marked loss of soil fertility in 1935, the area was planted with *Tephrosia* sp. The index cotton crop in 1938 yielded only 302 lbs. seed cotton per acre. The subsequent cover of the land may best be described as natural regeneration. After opening in October, 1945, the 3³ trial was planted towards the end of June, 1946. Such a date is not early for the area, but is early enough for the plants to become well established before the onset of the late rains. Highly significant yield increments due to nitrogen and phosphate individually, were recorded. The linear components were distinctive features for both treatments. There was no evidence of a significantly favourable response to potash. All fertilizers were applied two weeks after planting.

The $3 \times 3 \times 2$ (Nitrogen, Silico-phosphate and Varieties as at Kawanda), experiment with groundnuts was planted at a spacing of

one foot by six inches. Fertilizers were applied four weeks after planting and the experiment harvested after 110 days. Only differences due to nitrogen may be regarded as significant: of these the quadratic component accounted for the greater part of the difference. While the differences due to silico-phosphate were small, there was some evidence that there was a linear depressing effect, which was not significant at $p=0.05$.

NGETTA

The experimental area at Ngetta had been cropped for the previous two years. During the third year of cultivation, after a short grass ley the land was prepared on June 7th and unlike the similar trials at Kawanda and Serere, the fertilizers were broadcast prior to planting. Differences due to nitrogen were relatively small but significant at $p=0.05$. Differences due to phosphate and potash were not significant. There was no significant nitrogen $\times$ phosphate interaction.

EASTERN PROVINCE

Data are now available from three of the centres where 3×3 (Nitrogen and Silico-phosphate) trials were grown with *Eleusine*. In all instances fertilizers were applied about four weeks after planting. Only differences due to nitrogen may be regarded as significant. While differences due to silico-phosphate were small, there was in all instances some evidence of a depressing effect due to the double dressing. There was no significant nitrogen $\times$ phosphate interaction for the serial analysis.

SUMMARY

The responses to silico-phosphate have been in general disappointing. With the exception of a single trial with cotton in the Eastern Province, responses to the double dressing have been uniformly depressing. While at first thought it may be considered that the applications have been somewhat late, it has been shown that a small dressing, applied after planting, has given a satisfactory response with groundnuts. Further investigations, with germination, showed that in a 3^3 trial with Rock Phosphate, Nitrogen and Varieties, there were highly significant increments in germination at 12 days due to Rock Phosphate. These results were followed up in an experiment in collaboration with the Senior Chemist. In this experiment various treatments were tried and it was shown conclusively that silico-phosphate depressed the germination either of acid treated or untreated cotton seed. It is possible that for many of the experiments here reported the depressing effect of silico-phosphate may have been due to the effect on germination, especially when the dressing was applied before or very soon after planting.

It is clear that caution must be exercised regarding recommendations to be made for the general use of silico-phosphate in Uganda. While no specific advice can be given for rock phosphate, it has been demonstrated that its effect on germination is not similar to that of silico-phosphate. Further it has been shown for millets that a large application applied after planting has been as effective as silico-

phosphate in increasing yield. No information of real value is available, at this stage, regarding a possible nitrogen-phosphate interaction.

The effect of added nitrogen appears to depend largely on locality and soil type. In the Eastern Province, with lighter soils of inherently lower fertility, responses have been obtained with cotton, groundnuts and *eleusine*. In Buganda, with land of higher fertility, responses have been small and inconclusive. With such an uncertain indicator crop as cotton and possible differences in accumulated soil nitrates, much further work remains to be carried out. For the present it would appear that results to be expected from added inorganic nitrogen, on land in the first or second year of cultivation after a grass ley, are not likely to be of great magnitude. The possibility of obtaining large yield increments from land in successive years of cultivation after a grass ley, is now being investigated.

There appears to be no obvious deficiency in potash as indicated by three trials with cotton. There are, however, some indications that further experiments, particularly in regard to nitrogen-potash ratios, should be conducted as opportunity permits. For the present it would appear that while cotton continues to be grown under cloudy rather than sunny conditions, the results so far obtained from added potash are not inconsistent with those obtained in other countries.

At a spacing of $3' \times 1'$ for cotton, the opportunity for efficient plant development is somewhat restricted. Thus during the season under review higher yields were obtained from an early planted trial at a spacing of $4' \times 2'$. Until more is known about the effect of climate on growth, the optimum time of application of fertilizers, the adjustment of spacing for varying fertility and the comparative value of rock-phosphate *versus* silico-phosphate, specific fertilizer recommendations must be held in abeyance. During the coming year further trials are to be conducted on land in the third and fourth year of cultivation.

Acknowledgment

The writer acknowledges the valued co-operation of the Entomological Section: both the Senior Entomologist regarding *Capsid* data, and the Entomologist who made some valuable suggestions regarding the presentation of the Meteorological data. Recent investigations in connection with the effect of fertilizers on germination of cotton seed, were made in collaboration with the Senior Chemist, to whom acknowledgment is now made.

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Acting Senior Botanist.

REFERENCES

- UVAROV, B. P. (1932) Bioclimatograph, an Improved Method for Analyzing Bioclimatic Relations of Insects. *Ecology* XIII, No. 3 July 1932.
HARDY, F. (1946) *Trop. Agric.* XXIII, No. 11, pp. 201-211.
JAMESON, J. D. (1945) *Repts. Expt. Stations. E.C.G.C.* 1944-45.
HENDERSON, J.P. (1945) Unpublished Manuscript Relating to "Some Aspects of Rainfall in Uganda".

SERERE AREA

1. Introduction

The Botanist, Serere, proceeded on leave during the early part of 1947. The investigations here reported were conducted in the later stages by the Assistant Agricultural Officer. In presenting this brief summary, the Acting Senior Botanist, whose sphere was confined to the Buganda area, has drawn freely from the report of the Assistant Agricultural Officer.

THE SEASON

The rainfall summary, presented in Table 1 below, shows the extent to which the season differed from the monthly averages for 26 years. For the first time on record no rainfall was recorded during the months of January and February. This early deficiency was more than made up during the months April to August. Excessive rainfall during the months January to March, 1947, did much to reduce the yields below expectation.

TABLE 1

Month			1946	26 Year Average
January	..	..	Nil	0.79
February	..	..	Nil	2.37
March	..	..	4.06	3.56
April	..	..	10.83	7.95
May	..	..	8.21	7.34
June	..	..	6.94	4.41
July	..	..	3.57	4.53
August	..	..	12.25	6.68
September	..	..	4.94	5.99
October	..	..	1.96	4.32
November	..	..	4.42	4.02
December	..	..	1.27	2.01
TOTAL			58.45	53.97

2. Genetics and Breeding

Breeding work at Serere has, during recent years, been confined largely to strain testing of various selections from the three standard varieties N 17, B 181 and BP 50. Resistance to the Blackarm phase of *Bacterium malvacearum* has been considered to be of first importance. During this past season replicated trials were conducted with a view to estimating the cropping capacity of various blackarm resistant strains, compared with the parental types.

Separate variety trials indicated that for the N 17 group certain selections notably S4101, S4106 and S4108 had fewer blackarm lesions per plant and in addition higher yields of seed cotton than the N 17 standard. While the cropping capacity, during this season, of S4108 was outstanding in this group, there was some evidence, itself inconclusive, that the mean lint length was shorter than N 17.

Differences between the B 181 selections were small and inconclusive.

Both of these trials were planted during the middle of July and it was recorded that Blackarm lesions per plant tended to be rather higher for the B 181 group than for the N 17 derivatives.

A third small scale variety trial in which inter-family comparisons were made, indicated that certain strains of the N 17 group out-yielded the BP 50 and this in turn the B 181 derivatives.

3. Agronomy

DISTRICT VARIETY TRIALS

The standard 5×5 latin squares were laid out at 19 centres. These centres are grouped according to fairly well defined ecological areas. For North-west Uganda, varietal comparisons include N 17 and its derivatives against BP 52 and BP 50. Those for South Lango and Teso include N 17 and its derivatives against B 181 and BP 50. The Bukedi area compares N 17 and its derivatives with BP 50 and BP 52. Finally for the largest cotton growing area of the Eastern Province—Busoga—the comparison consists of N 17 and its derivatives against BP 52.

Yields of seed cotton in pounds per acre from these District Variety Trials are given, for the planting dates, in Table 2 below.

It is evident for this season that N 17 or its derivatives, have cropping capacities at least as good as selections from Buganda local which include S5301 and S5302.

SOWING DATE TRIALS

As for Buganda the question of optimum sowing date was re-opened. The nature of the climatic regime and the importance of food crops, limit the possible sowing dates to the period mid-May to mid-August, for the Northern and Eastern Provinces.

Two sowing date trials were conducted during the season; one included five varieties at three sowing dates and the other a single variety also at three sowing dates. From the former there was no differential yield response due to variety at the different planting dates. As a result the precision of the comparisons at different dates, being based on a larger effective number of replications, provided an accurate estimate of the likely response due to different planting dates.

Data for this trial are summarized in Table 3 below and it will be observed that the highest yields were recorded from the earliest plantings.

TABLE 3
VARIETY AND SOWING DATE TRIAL

(a) By Dates

Sowing Date	% Stand	<i>Lygus</i> Damage per plant	B.A. Lesion per plant	Seed Cotton Lbs./Acre	Ginning per cent	Mean Lint Length mm.
20 May ..	67.8	0.3	2.6	849	33.2	33.4
17 June ..	75.2	1.1	2.5	564	32.9	33.8
15 July ..	85.7	0.4	3.6	498	32.5	34.0

(b) By Varieties

Varieties	% Stand	<i>Lygus</i> Damage per plant	B.A. Lesion per plant	Seed Cotton Lbs./Acre	Ginning per cent	Mean Lint Length mm.
BP 52 ..	78.8	0.6	2.8	618	33.1	34.7
SP 84 ..	73.8	0.5	3.2	614	34.3	33.3
BP 50 ..	75.8	0.7	1.9	724	32.4	34.7
N 17 ..	74.5	0.6	4.8	574	31.6	32.1
B 181 ..	78.4	0.6	1.6	653	32.9	33.8

TABLE 2

DISTRICT VARIETY TRIALS FOR THE NORTHERN AND EASTERN PROVINCES
YIELDS OF SEED COTTON PER ACRE 1946-47

Area		Locality Yield 8 Years		Sowing Date			Varieties		Loca- lity Yield 1946-47
				N 17			BP 50	BP 52	
NORTH-WEST UGANDA				Bulk	S4101	S4112	S5302	Bulk	
Ngetta	769	2 July	1,142	1,270	1,187	1,353	1,151	1,221	
Kitgum	838	22 July	900	884	873	892	851	880	
Gulu	702	26 July	837	873	763	788	832	819	
Nebi	866	5 Aug.	804	809	706	721	744	757	
	794	Means ..	921	959	882	939	895		
				N 17			BP 50	B 181	
SOUTH-LANGO AND TESO				Bulk	S4108	S4112	S5302	S5301	
Kuju	465	27 May	560	627	541	537	544	562	
Kumi	507	24 June	652	956	609	869	705	758	
Kaberaimaido ..	653	25 June	574	666	711	727	601	696	
Serere	728	29 June	523	911	549	748	733	693	
Aduku	985	1 July	1,398	1,721	1,410	1,517	1,287	1,467	
	668	Means ..	741	1,016	764	880	774		
				N 17			BP 50	BP 52	
BUKEDI				S4105	S4108	S4112	S5302	Bulk	
Bukedea	661	26 June	1,044	1,206	925	1,052	1,065	1,058	
Kibale	579	23 July	486	565	484	409	491	487	
Kisoko	669	24 July	583	944	619	642	735	705	
Budaka	629	27 July	391	513	397	407	375	417	
	635	Means ..	626	807	606	628	667		
				N 17			BP 52		
BUSOGA				Bulk	S4101	S4105	S4112	Bulk	
Bulopa	728	18 July	582	902	564	661	742	690	
Vukula	880	18 July	801	1,088	783	998	853	905	
Bugaya	284	19 July	298	384	314	469	339	293	
Nawanzu	817	20 July	1,348	1,333	1,283	1,199	1,330	1,300	
Nakabango ..	1,038	6 Aug.	596	823	721	964	1,015	824	
	749	Means ..	725	906	733	858	856		
				B 181			SP 84	BP 50	
NORTH TESO				Bulk	KP 28	S5301	Bulk	S5302	
Katakwi		21 May	850	793	854	730	833		

The aim of the second trial was to ascertain whether contiguous plots at different planting dates result in a migration of insects from earlier to later planted cotton. Where such a migration does take place on a large scale, the advantages demonstrated in former years as being due to early planting, would be largely vitiated. Insect attack, particularly *Lygus*, was of low intensity on all plots. The yields from the three dates 20th May, 20th June and 20th July were 714, 612 and 600 pounds per acre. While these data were essentially similar to the other sowing date trial, and others conducted in previous seasons, the information regarding insect migration was necessarily inconclusive.

The inferences to be drawn from these most recent, and previous sowing date trials, conducted at Serere, indicate that earlier planted cotton almost invariably gave higher yields. It is possible that the growth habit from the earlier planted cotton is less efficient than from later planted cotton; the general appearance of the earlier planted cotton is generally of excessive vegetative growth. However, until such time as a short term cotton may be evolved, and which can mature under Eastern Province conditions from later planting, it would appear that less crop risk is involved when cotton is planted during June.

PROGRAMME FOR 1947-48

Pending the appointment of a Botanist, the programme will be considerably reduced. The more important projects are as follows:—

- (1) Maintenance of Breeding Stocks of the main varieties N 17, BP 50, B 181 and BP 52.
- (2) Small scale family testing of the most prominent recent selections.
- (3) District Variety Trials at 19 centres in the Northern and Eastern Provinces.
- (4) Combined Sowing Date and Variety Trial.

REPORT ON KAWANDA EXPERIMENTAL STATION

1. Meteorological

Month	Rainfall		Mean Max. Temp.		Mean Min. Temp.	
	11 year Average	1946	8 year Average	1946	8 year Average	1946
1946—						
January	2.06	1.13	84.2	87.4	59.5	59.4
February	2.42	0.09	85.0	89.3	60.0	59.1
March	4.24	3.13	83.4	86.2	60.8	62.2
April	6.39	5.75	81.8	80.6	62.6	62.8
May	5.50	5.96	79.1	79.1	61.6	61.5
June	2.39	1.75	79.1	77.7	59.4	59.6
July	2.03	2.20	78.6	79.1	58.4	59.1
August	3.67	5.18	79.4	76.8	59.3	60.4
September	4.08	3.18	81.2	79.5	59.3	60.2
October	3.91	6.04	82.8	81.5	60.9	60.6
November	4.67	3.80	81.4	81.5	61.0	60.6
December	3.37	2.20	82.4	82.1	59.4	59.8
TOTAL	44.73	40.41	81.5	81.7	60.2	60.4
1947—						
January	..	4.40	..	..	..	..
February	..	1.96	..	..	..	..
March	..	3.57	..	..	..	..

January, February and March, 1946, were considerably drier than average, which facilitated cotton picking, but delayed planting of early food crops. Good well distributed rains were received in April and May, and the soil did not dry out until well into July. Well distributed rains were received in August, September and October and mean maximum temperatures during this period were below average. Rains continued through November, December and January and there was a very marked absence of a dry season early in 1947. The early rains of 1947 broke early, but were badly distributed, which made germination of early sown crops unusually erratic. Meteorological figures were supplied by the Senior Botanist, who discusses the figures in greater detail in his Annual Report.

2. Labour

No difficulty was experienced during 1946 in getting sufficient labour, though there has been a reduction in numbers of Acholi and Lango employed and an increase in numbers of Banyaruanda. This has involved some reduction in labour efficiency, as the Acholi form the bulk of the labour with many years' service on the farm. Acholi have mainly left owing to more attractive conditions offered by non-Government employers.

3. Main Farm—Rotations

Rotations in use on the farm were changed considerably as the result of decisions reached in 1945. An abnormal amount of work, particularly clearing, was required during the year under review to get all blocks into the rotation as previously laid down.

Experience during the year brought to light a number of faults in the rotations and these have been rectified in the 1947-48 programme. The main fault was that insufficient care had been taken to see that no long fallow periods intervene between successive crops. Under Kawanda conditions such fallow periods almost invariably cause rapid growth of lumbugu (*Digitaria scalarum*), and considerable increases in cultivation costs. Gaps have been avoided by growing three crops in the year in certain cases, by replacing the rather useless *Setaria italica* crop grown in past years by maize, by "telescoping" such crops as maize and cotton, and by growing beans before cotton on new land when opening early in the year is desirable.

4. Main Farm—Cropping

(a) COTTON

BC 66, a BP 52 derivative, was grown on the Main Farm. The total area was 24½ acres which gave an average yield of 580 lbs. per acre and a fifti percentage of 18%. The ginning out-turn was 32.0%. Comparative yields in other recent years are :—

Year	Acreage	Variety	Yield Seed Cotton per acre	Fifti %
1941-42	19.8	B.P.52.B	784	7.4
1942-43	20.3	B.181	965	4.2
1943-44	20.9	B.181	523	4.8
1944-45	23.1	B.P.52	508	16.6
1945-46	20.6	B.P.52	919	4.0
1946-47	24.5	B.C.66	580	18.0

Planting started on the 15th May and was completed on the 15th August. Sowing date trials were carried out by the Senior Botanist on main farm blocks and will be reported upon by him.

Conditions for germination were favourable in that sufficient moisture was always present in the soil, though exceptionally low temperatures in August probably retarded early growth. The crop made good progress from September to December, but prolonged rain and absence of sun during the harvesting period made picking difficult, and undoubtedly reduced the crop considerably.

(b) MAIZE

Owing to a very late onset of the main rains planting in 1946 was not carried out until early April. The crop made a good recovery, thanks to good rains later during the season. The main variety grown was Maratha, a long term white variety, and yields obtained were 9-10 bags per acre. The crop was reduced by insufficient resting period between initial opening of the land and planting. In the 1947 season a very clear object lesson in the necessity of opening land for maize at least 5-6 weeks before planting has been noted at Ngogwe. Part of a fertilizer trial planted there five weeks after clearing has made good growth; another block planted three weeks after clearing is growing to about half the size, and has shown clear signs of nitrogen starvation.

The early onset of the rains in 1947 made planting in February and March easy, though the rather patchy storms received at Kawanda caused poor germination on land not properly consolidated. Two new varieties, K 3 and K 8 one of which is a short term white and the other a long term yellow, which did well in the Botanist's variety trials in 1946, are being grown as well as Maratha.

Part of the 1947 maize was intersown in cotton some weeks before the cotton was uprooted. Growth was etiolated in the early stages, but the plants appear to have recovered from this.

(c) BEANS

A summary of beans yields obtained during recent years at Kawanda is given in Appendix I, together with some notes on the characteristics of these varieties. Yields are not necessarily the most important characteristic of bean varieties, and the following varieties are considered the most promising :—

<i>Mutike 4</i>	..	..	Spreading. Purple seed. High yield.
<i>Banja</i>	..	..	Upright. Fair yield. Quick maturing. Probably best as interplanted crop. Speckled bean.
<i>Bukalasa No. 2</i>	..	..	Poor yield, but considered very palatable.
<i>White Kidney</i>	..	..	Fair yield. White bean. Palatable.
<i>Abundance</i>	..	..	Climber. Ripens over several weeks, and the most successful as a French bean.
<i>Tepary</i>	..	..	Very drought resistant. Quick maturing. Small white bean. Best variety for planting when little rain is expected. Not very palatable.
<i>Mixed Mutike</i>	..	..	Similar to Mutike No. 4, but erect growth habit. Rather slow maturing.
<i>Kagi</i>	..	..	Fair yield. Small white bean. Spreading. Not very palatable.
<i>Kainja No. 1</i>	..	..	Fair yield. Erect growth. Purple bean. Palatable.
<i>Maguluganamunye</i>	..	..	Fair yield. Small black and white striped bean. Spreading. Not very palatable.
<i>Namunye</i>	..	..	Fair yield. Large black and white striped bean. Spreading. Palatable.

“Palatability” refers both to taste and length of time required for cooking.

(d) SWEET POTATOES

In the 1945-46 season, yields of sweet potatoes had been low on all sections of the farm. In the 1946-47 season, care was taken to ensure that planting material of known varieties only was used. Though planting mixed varieties may have advantages in the case of the small farmer who plants and harvests his own plots for his own use, this

year's results suggest that a major reason for poor yields in the past here has been propagation of inferior varieties. Similar observations have been made at Serere in the past. On Block IX, Strip 6 (4.45 acres) the varieties Namujuna, Kitikyambazzi and Gafemulago were grown and gave a gross yield of 24 tons, an average of 5.4 tons per acre. Namujuna and Gafemulago gave better yields than Kitikyambazzi and Kawungezi.

In the Kababbi swamp small plots of these varieties interplanted in young eucalyptus gave the following yields :—

	<i>Tons per acre</i>		
Namujuna	..	..	8.0
Gafemulago	..	..	4.9
Kitikyambazzi	..	..	4.3
Kawungezi	..	..	2.6

All sweet potatoes were grown on ridges and interplanted in the early stages with beans. Bean yields at times of the year when weather was favourable averaged about 200 lbs. per acre, which will fully justify planting them.

In the 1946-47 season a number of requests have been received for planting material of yellow fleshed high carotene content sweet potato varieties. Caroline Lea has been obtained by the Senior Botanist and the Senior Entomologist from Tanganyika : Kayulu, a local yellow fleshed potato, is also being increased.

A number of additional introductions of local varieties of reputed high yielding properties have also been made.

(e) SOYA BEANS

Hernon 29 sown on 19th March, on Block VIII, Strip 1, gave a yield of 1,157 lbs. per acre. The same variety sown on Block VIII, Strip 3, on 11th September, yielded at the rate of 798 lbs. per acre.

A number of new varieties were taken over from the botanical section for increase in 1947. Most of these germinated badly ; this was due to the necessity to store them for some considerable time in bags after harvest in 1946. Additional drying space has been built this year, so it is hoped that this trouble will not occur again.

(f) ELEUSINE

1½ acres of a mixture of three Teso varieties, Engenyi, Emoru and Ekwakoit gave 3,300 lbs. unthreshed heads per acre (about 2,400 lbs. of grain).

(g) GROUNDNUTS

A yield of 1,770 lbs. unthreshed nuts of the variety B 227 was obtained on Block X, Strip 1. This crop was sown broadcast.

In 1947 the south end of Block X, Strip 3, was broadcast with the same variety. Germination was poor, the main reasons being poor soil consolidation. Considerably better stands have been obtained on Block VII, Strip 6, where seed was sown by the local "chop and plant" method, and costs of this method of planting are little higher than broadcasting.

(h) CASSAVA

Five of the Amani mosaic resistant types planted on 10th April, 1945, on Block X, Strip 2, were harvested in July, 1946, and gave the following yields :—

Variety		Yield of fresh tubers per acre	
		<i>Tons</i>	
No. 7	.. ..	3.9	
No. 8	.. ..	7.7	
No. 11	.. ..	6.8	
No. 13	.. ..	4.4	
No. 15	.. ..	4.8	
No. 43	.. ..	4.2	

No. 15 has subsequently been discarded for poor mosaic resistance in the field. No. 43 gives a very dense cover and controls weed growth effectively, but is very fibrous and not considered very palatable.

Block X, Strip 4, was planted with variety Nos. 7, 8, 11, 13 and 43 in May, 1946. Harvesting was started in May, 1947. This cassava was interplanted in the first place with groundnuts (B 227) and beans (*Banja*), which produced 160 and 730 lbs. per acre. After harvesting beans and groundnuts tepary beans were planted on 16th September and produced 148 lbs. per acre, a yield which more than covered costs as the cassava would have to be weeded anyway.

Cassava planting material from these plots was issued to field officers and growers in North Mengo and Mubende.

The palatability, storing qualities and yields of these mosaic resistant varieties are being investigated in a comprehensive experiment laid down by the Senior Botanist in 1947 on land near the piggery.

(i) ENGLISH POTATOES

The varieties Rhod Star, Nyeri, Toro Blue and Nanyuki have been grown in both rains of 1946 and in the early rains of 1947. Small out-of-season plots were also grown in the Kababbi swamp. Toro Blue in general gave the best yields, and is the earliest maturing of these varieties, though it is a poor keeper. The yield range was $\frac{1}{2}$ to 6 tons per acre. The best yield was from $\frac{1}{4}$ acre of Rhod Star planted on rich "skirt" land in the swamp sown in December and harvested in March which produced nearly 6 tons per acre interplanted in Eucalyptus.

Comparisons between the normal temperate climate method of planting in deep ridges with the American shallow trench method adopted by Mr. Manning on Botanical areas showed that the latter is the better method, and this method is now being used on all parts of the farm.

(j) SETARIA ITALICA

Yields of 2,000 and 1,135 lbs. per acre were obtained from early sowings of this millet on Block IX, Strip 1, and Block IX, Strip 8. In 1947 this crop has been replaced by maize. It has been grown for several years at Kawanda without any signs of local farmers taking an interest in it: it had been used as a stock feed, but is considered less valuable for this purpose than maize, *sorghum* or *eleusine*.

(k) PEAS

A half-acre plot of Mauritius Field Pea sown on Block IX, Strip 6, in May and harvested in August gave a yield of 697 lbs. per acre. Similar sized plots of Harrison's Glory (marrowfat) and Early Market Giant Garden Pea sown in September and harvested in November, on Block VIII, Strip 3, gave yields of 530 and 420 lbs. per acre. The Early Market Giant is an excellent garden pea and considerable quantities have been distributed to vegetable growers.

(l) SORGHUM

Namatera sorghum sown on Block X, Strip 1, in September, was harvested in January and gave a yield of 2,705 lbs. per acre of unthreshed heads (1,500 lbs. grain). Straw was cut and used for mulch and a ratoon crop taken. This was harvested in May and yielded 1,074 lbs. per acre. This ratooning sorghum, which is a beer variety popular in this neighbourhood and also useful for stock feed, is a useful crop to take before cotton.

(m) MISCELLANEOUS CROPS

Three new varieties of *Sunflower* were sown and gave poor yields. *Kenya white* did well.

Sunn hemp.—A plot was grown as requests for seed of this cover crop are frequently received.

A plot of the small white Teso variety of *cowpeas* was sown on 4th December: it was harvested in March, 1947, and gave a yield of 320 lbs. per acre.

Madagascar Butter beans were grown in the dry season and did well. There is a considerable demand for seed of this crop.

5. Main Farm—Treatment of Resting Land

On Block IX, Strip 6, elephant grass followed a crop of sweet potatoes in the fourth year of the rotation. Sweet potatoes were harvested for human and cattle feed each day during the period December, 1946, to March, 1947. As the potatoes were harvested tops were removed for cattle feed, elephant grass stems placed in the potato furrows and covered with soil as the roots were dug out. This method of planting elephant grass is cheap and produced a very fair stand even in rather dry weather.

On most other parts of the farm elephant grass was planted in the furrow behind the disc plough. Where land was reasonably free of other grasses the stand obtained was fairly good. The most important consideration appears to be to get land planted immediately the last crop has been harvested, and before lumbugu (*Digitaria scalarum*), and other grasses have had time to establish themselves.

6. Mechanical Cultivation

During 1946 the only mechanical tool used was a four furrow Dragoon disc plough drawn by a D.4 Caterpillar tractor. Costings of mechanical cultivation, and comparisons with hand labour, are being made. Tentative indications are:—

(a) The running costs of a D.4 work out at about Shs. 2/40 per hour.
 (b) The average time taken to plough an acre came to 1.3 hours.
 (c) Based on capital cost of Shs. 20,000 and depreciation at 10% per year costs of ploughing with this unit rise from Shs. 5.70 per hour with 1,000 hours worked per year to Shs. 13.50 with 250 hours worked per year.

(d) A reasonable estimate for costs of opening new land from elephant grass with this equipment is Shs. 20 for tractor costs plus Shs. 20 for hand labour, *i.e.*, Shs. 40; with hand labour only a comparable figure is Shs. 60 to Shs. 100. Hand labour based on Sh. 1 per man day. If land is heavily infested with couch costs would be much higher, and the tractor make little saving.

During the early months of 1947, the farm D.4 tractor and plough have been hired to a few tenants on Crown Land on Kawanda Seed Farm. It is too early yet to discuss results.

Two small six horse power tractors have been obtained early in 1947, a Trusty and an Anzani. Drivers take some time to get used to these implements, and reliable information as to their performance cannot yet be given.

AGRONOMY EXPERIMENTAL WORK

7. Coffee Costings.

Following a good crop in the 1945-46 season, the crop in 1946-47 was poor. Yields and costings are given in Appendix II. The following observations are worth noting:—

(i) Cotton seed as a manure has not yet given an appreciable yield response.

(ii) Mulched plots have shown more pronounced yellowing than other plots. In August, 1947, leaf samples were taken from each tree in plots 1 to 7. Three samples were taken from each tree, top, middle and bottom and each leaf graded as "yellow", "Partly yellow" and "green" by an African employee not familiar with the purpose of sampling. Distribution was as follows:—

Plot No.	Treatment	Percentages				
		A Yellow	B Partly yellow	A & B	Green	TOTAL
1	Not mulched. <i>Leucaena</i> cover.					
	No shade	2	12	14	85	99
2	Mulched. No shade	23	46	69	32	101
3	Mulched. No shade	26	44	70	30	100
4	Not mulched. Banana shade	20	20	40	60	100
5	Not mulched. Banana shade	21	20	41	58	99
6	Not mulched. Fig and banana shade	18	21	39	61	100
7	Mulched. Fig shade	11	31	42	58	100

The figures confirm visual impressions, though Plot 7, where the mulch is combined with *Ficus* shade, shows no more yellowing than unmulched plots.

(iii) In Plot 13 there is a row of elephant grass after each fourth row of coffee. Visual impressions suggest that trees next to elephant grass have poorer growth than the two central rows not adjacent to the elephant grass. Mean yields per tree since the experiment was started in 1943 of trees adjacent to elephant grass rows is 11.6 kgm. of fresh cherry whereas the mean yield of trees not adjacent is 13.0 kgm. The difference is not significant.

(iv) Plots with *Leucaena glauca* cover have continued to give poor yields, see Appendix II.

(v) In many cases the precise method of carrying out a treatment in a trial of this nature may have a large effect, frequently as great as differences between treatments. The methods used in the past for application of mulch, for cutting of the *Leucaena* ground cover and for cutting back elephant grass rows require reconsideration.

8. Banana Manurial Experiment

This unreplicated comparison between bananas with (a) No Manure, (b) Farmyard Manure applied at the rate of 5 tons per acre per year, and (c) cotton seed applied at the rate of $2\frac{1}{2}$ tons per acre once per year was started in 1942. Plot Size is approximately $\frac{1}{3}$ acre :—

Treatment			Gross Yield 1943-45	Yield 1946	Gross Yield 1943-46
			lbs.	lbs.	lbs.
Farmyard Manure	..	..	5,296	2,206	7,502
Cotton Seed	..	..	3,927	1,708	5,635
Control	..	..	4,232	2,082	6,314

Treatment			Average Weight of Bunch 1946	Number of Bunches 1946
			lbs.	
Farmyard Manure	..	..	16.5	134
Cotton Seed	..	..	12.9	132
Control	..	..	15.9	131

9. Elephant Grass Manurial Experiment

This experiment, which was started in 1943, contained four blocks each of which was divided into two plots, one manured with 10 tons Farmyard Manure per acre per year and the other not manured. Yields in thousands of pounds of green material per acre are :—

YIELD OF ELEPHANT GRASS
1,000 lbs. green material per acre

Block	1943 1 cut		1944 3 cuts		1945 3 cuts		1946 2 cuts		TOTAL	
	No Manure	No manure	No Manure	No manure	No Manure	No manure	No Manure	No manure	No Manure	No manure
I.	21	13	78	35	66	21	31	11	196	80
II.	19	10	78	32	52	18	24	11	173	71
III.	21	9	57	24	24	9	14	5	116	47
IV.	12	8	29	17	17	8	11	5	69	38
Means	18.2	10.0	60.5	27.0	39.7	14.0	20.0	8.0	138.5	59.0

By the middle of 1946 the whole experiment had been much invaded by lusenke, *Imperata cylindrica*. Weights given are of elephant grass cut only. It was not possible to weed out the *Imperata*, and the experiment has been discontinued. The results obtained from it are : —

(i) Elephant grass manured with 10 tons of Farmyard Manure per year gave more than twice the yield of unmanured elephant grass.

(ii) Under a system of four monthly cutting with little weeding manured plots gave a yield of about 30 tons per acre per year in the second year after planting, but yields decreased in the third and fourth years as *Imperata* invaded the plots. This does not show that elephant grass cannot be maintained in a reasonably good stand when cut for feed: good persistence shown by elephant grass rows mentioned in section 10 disproves such a statement. It shows, however, that if a reasonably good stand of elephant grass is required over a number of years with periodic cutting the grass must be weeded and manured.

10. Elephant Grass Variety Rows

Thirteen selections from promising progenies were made in 1943. Each selection was planted in rows 258 feet long with 10 feet between the rows. They have been weeded and were manured in January, 1947, with Farmyard Manure at a rate of about 30 tons per acre.

YIELDS (Green Material per acre in 1,000 of pounds)

Row No.	1943-45	1946	1943-46	Row No.	1943-45	1946	1943-46
1	78	62	140	8	79	52	131
2	115	51	166	9	103	61	164
3	121	73	194	10	126	43	169
4	90	49	139	11	81	47	128
5	119	83	202	12	88	43	131
6	106	49	155	13	11	23	34
7	96	88	184				

Row No. 4 is the semi-hairless type, which is reputed to be the most palatable for cattle.

11. Continuous Cultivation Experiment

This experiment was started on Block I early in 1947. Main treatments are :—

- Continuous cultivation without manuring.
- Continuous cultivation with Farmyard Manure.
- Continuous cultivation with fertilizers.
- Alternate cultivation (3 : 3).

12. No-Light-Heavy Grazing—Chloris and Elephant Grass

An experiment comparing these treatments in a replicated layout capable of determining the effect on the animal as well as the effect on the soil was started early in 1947 on Block II, Strip 7.

13. Perennial Crops

Since the departure of the Senior Economic Botanist on retirement towards the end of 1946 supervision of his observation plots on a care

and maintenance basis has been taken over by the farm. These plots include :—

- (a) Tea. Seed increase plots. The seed produced has been sold.
- (b) Derris.
- (c) Cinchona. Increase of selected progenies.
- (d) Coffee. Harvesting and recording of yields of selections made in the past by the Senior Economic Botanist.
- (e) Orchards, etc. Maintenance only.

GRASSES AND GRAZING

14. Grass Plots

This collection has been maintained. Seed of certain promising varieties has been collected for sowing in grazing observation plots.

15. Grazing Observation Plots

BLOCK II, STRIP IX

Ten one-fifth-of-an-acre plots were planted by sets with ten grass species in July, 1945. Grazing with adult bullocks was started in May, 1946. All plots were grazed five times during the period May, 1946, to March, 1947, and "grazing day" records are given in Appendix III together with some notes on the condition and persistence of the species planted. In 1945 this land had just completed three years' cropping. In Appendix IV, additional notes on the behaviour of these grass species are given, based on experience gained on this and other trials at Kawanda. The Teso strain of Rhodes grass, *Chloris gayana*, is the only species yet tried which has a chance of being worth growing instead of elephant grass.

"Natural Regeneration" at Kawanda consists very largely of couch, *Digitaria scalarum*, with varying amounts of herbaceous weeds and *Panicum trichocladium*. When the quantity of the latter grass is considerable carrying capacity is not much inferior to that of seeded species, but elsewhere the carrying capacity is low. Couch invasion anyhow makes natural regeneration undesirable.

"Grazing days" given in Appendix III are an indication only. Cattle remain on the plots from 4 p.m. to daybreak on each grazing day, and this period has been given an arbitrary value of half grazing day.

16. Grass Palatability Plots

BLOCK IX

It is doubtful whether these plots can fulfil any additional useful purpose and observations have been discontinued.

17. Additional Grazing Observation Plots

On Block VIII, Strip 4, plots were sown with *Chloris gayana* (Teso), *Sorghum verticilliflorum* (Kavirondo Sorghum), *Paspalum dilatatum* and one plot left to natural regeneration. On Block VIII, Strip 2, in the previous year (1945) *Chloris gayana*, *Brachiaria mutica*, *Cynodon*

plectostachyum and Kavirondo Sorghum had been tried. Results are included in the summary given in Appendix IV.

Seed of *Paspalum dilatatum* used came from South Africa and failed to germinate. This was a fault of the particular consignment of seed received, not of the species.

18. Grazing of Elephant Grass

Attempts made in the past to graze planted elephant grass have not been successful because it dies out after one to two years. The suggestion has been made that this grass will stand up to grazing provided it is allowed to become well established in the first place and is subsequently cut back some considerable height above ground level, i.e., the grazed grass consists of side shoots growing out from thick hard inedible stems. To try out this suggestion plots have been planted on Block II, Strip 8, part of which have been cut back at 18" after the stems had become mature and part at 30". Preliminary indications are that both of these methods of cutting will produce a "pasture" capable of persisting for some considerable time, though yields of grass in the early stages will be lower than when young stems are grazed right down, and provided grazing is managed on a rotational system with sufficient paddocks to prevent localized overgrazing.

19. Carrying Capacity

About seven acres of ley grazing are available each year on Block VIII. Starting from January, 1947, this is being stocked with ten adult beasts (nine cows and one bull). This rate of stocking so far seems to be about right. The beasts receive supplementary food.

20. Swamp Utilization

Many swamps in the Kampala neighbourhood are now being drained and used for cultivation. Additional timber supplies are required at Kawanda, and it was considered advisable to plant up the Kababbi swamp with Eucalyptus. This was considered a useful opportunity to obtain some information as to the possibility of cropping such swamps. Observation pits have been opened to follow changes in water table and soil types.

Sweet potatoes have done quite well throughout the swamp. English potatoes did very well on the strip of "skirt" land where an admixture of swamp soil and ordinary soil is found. Beans and peas failed.

LIVESTOCK

21. Livestock—Cattle—General

(a) HERD NUMBERS

	Herd Numbers			No. in herd on June 30th	
	1943	1944	1945	1946	1947
Bulls	1	1	1	2	3
Oxen and young steers ..	6	6	6	35	41
Cows	7	13	25	31	44
Heifers	9	15	11	22	14
Calves	6	21	34	30	22
TOTAL ..	29	56	77	120	124

(b) BREEDING AND SELECTION

A Zebu bull out of one of the best milking cows at Ngetta was received in October, 1946. He has been put to a bunch of Zebu type cows.

Two Nganda type bulls are in use : one Kawanda bred out of one of our best milking cows, the other brought locally from a herd known to contain high milkers.

A rigorous policy of culling has been adopted in the cow herd, and we are now just attaining the position where only cows giving 75 gallons of milk or more with calf at foot can be discarded. With high site values and heavy feeding policy adopted at Kawanda, relatively high milk yield is necessary in order to cover costs.

(c) MILKING

Since September, 1946, all heifers coming into the herd have been hand-milked, and calves pail fed. Of four heifers milked out two have completed reasonable lactations for first calvers, one started with a good milk yield but died of heart water and the fourth failed to give milk. Hand reared calves have been fed on the Maseno ration ; they have given good live-weight gains in the first three months, but difficulty has been experienced in getting them through the change over period from milk to solid food. At one time vitamin or mineral deficiencies were suspected, and they have been given a mineral lick and fed spent brewers grains : it now appears more probable, however, that intestinal worms were the main reason for poor growth at this stage. They have responded to dosing with Phenothiazine. Four pail-fed calves who have completed their period of feeding on whole milk have consumed 73, 68, 54 and 58 gallons respectively. The main reason for adopting pail-feeding is to obtain accurate records and a supply of cows who could be used for feeding experiments in the future ; the possibility of rearing calves when the mother dies or has no milk, and of getting the cow's milk when the calf dies appeals to the African stockowner, but it is doubtful whether these advantages outweigh the additional costs of handling and rearing the calves.

A set of milking bales have been built. These have been of considerable value in allowing individual feeding and handling of heifers before they calve down. A number of local farmers have seen these bales and are interested ; one or two have so far copied them.

LACTATIONS COMPLETED IN 1946

Gallons	Lactations					Number culled
	1st	2nd	3rd	4th	TOTAL	
0-24 ..	2	1	1	2	6	5
25-49 ..	2	3	1	1	7	3
50-74 ..	Nil	1	2	..	3	..
75-99 ..	3	Nil	1	1	5	..
100 and over ..	1	2	1	..	4	..
TOTAL ..	8	7	6	4	25	8

A separator has been purchased. Butter fat prices here work out at about 80 cents per gallon of whole milk compared with Shs. 2/40 per gallon for liquid milk, so there can be no good grounds for selling butter fat when a liquid market is available. A certain amount of cream is, however, being sold at prices equivalent to the liquid milk price, and the main reasons for obtaining a separator are : (i) in order to reduce whole milk consumption by calves, and (ii) to provide small quantities of separated milk for feed to young pigs.

(d) HOUSING

A dairy has not yet been built. A cob store was built in 1946, which is temporarily being used as a dairy as well as for storage of feeding stuffs. A block of cob houses has been built to accommodate herdsman and livestock learners.

(e) FEEDING

A number of empirical trials with different local feeding stuffs have been made. In the past cotton seed and simsim or groundnut cake had been the main concentrates given. Early in 1947, a start was made with feeding cassava and sweet potatoes in addition, following suggestions made by local stock owners. Responses in milk yield have been very noticeable, particularly among the large Nganda type cows.

Hand-reared calves are now being given maize meal in their milk from eight weeks of age, and given access to a mixture of kibbled maize, oil cake and sweet potatoes or cassava. Cotton seed is started at the weaning age.

(f) GRAZING

In the past all cows at Kawanda had been grazed out at night. Though all evidence suggests that this is desirable, herding costs are very high when fenced enclosures are not available. Fenced enclosures are available for two out of our three herds, and the third herd is now being kept in at night. Additional paddocks will, it is hoped, be fenced in before long.

(g) HEALTH

Health of the herd has been good. One cow was slaughtered following an abortion and retention of the afterbirth. One cow died from heart water. All calves presumably had East Coast Fever, but in most cases symptoms were slight. Two calves and one weaner died during the year, in each case East Coast Fever was the probable cause, though a positive slide was only obtained in one case.

Tick infestation in the herd is heavy at certain times of year. Arrangements had been made in 1946 with the Veterinary Department to put in a dip, but this had been held over and it is now hoped that adequate control will be possible by using sprays with Gamatox or D.D.T.

The Senior Entomologist, in co-operation with the Veterinary Research Officer at Entebbe, carried out trials with spraying D.D.T. on cattle with the view to reducing *Stomoxys* fly infestation. The trials were not successful.

(h) WEIGHBRIDGE

A cattle weighbridge was installed in September, 1946. Regular weighing of all calves and young stock is now being carried out, and is proving of value in checking feeding and supervision. In the course of time the figures, when compared with figures from Serere and other Experiment Farms, will be of value to estimate the productivity of our local cattle, and to make comparisons between different strains.

22. Stall Feeding Trials

For a number of years trials have been conducted at Kawanda to test:—

(i) Whether it might not be an economic proposition to buy store cattle in Teso and bring them down to the environs of Kampala for fattening.

(ii) To compare cut elephant grass with grazing as the main source of feed.

In 1946 a bunch of 12 Teso bullocks were bought for Shs. 170 each in May. They were given normal concentrates and grazed until the end of August and put into a grazing trial from September, 1946, until February, 1947. They were subsequently slaughtered on the farm and gave an average return of Shs. 205 per beast (meat Shs. 182: hide Shs. 23).

(i) ECONOMIC CONSIDERATIONS

Feeding costs worked out at about 11 cents per beast per day. Labour costs are always unduly high for experimental animals, but assuming that one herdsman per 20 beasts would be a reasonable figure, these costs would come to 5 cents per day. The cost per beast of keeping from June 1st to February 1st, would then work out at Shs. 39 20 per beast, or say Shs. 50 to allow for interest on money invested and depreciation on buildings, etc. On this basis fattening here certainly did not pay, as the difference between buying and selling prices was Shs. 35 only. This, however, is not a fair comparison: the price paid of Shs. 170 was an open market price in Teso, *i.e.*, a price based on the Kampala black market meat price, whereas the selling price was based on controlled meat prices. Mr. H. G. Stewart, Veterinary Officer, estimated that a fair market price for the bunch at Christmas was Shs. 250 each, and I have no doubt that this price could have been obtained from local butchers. Such a price would have left a reasonable margin of profit, though by no means an excessive margin: we were lucky that none of the 12 beasts brought down contracted East Coast Fever or other diseases frequently contracted by cattle brought down from Teso to Buganda. Profit would also depend very much upon a careful choice of animals in Teso, and in particular insistence that bullocks from E.C.F. infested areas only were bought.

(ii) COMPARISON OF STALL FEEDING WITH GRAZING

The 12 bullocks were divided into the six heaviest and six lightest, and each bunch divided at random into two sets of three for stall

feeding and grazing. All bullocks had a full set of teeth, and none were badly worn down, so ages presumably ranged from 5-8 years.

Concentrates fed during the experimental period were (per day in pounds):—

	I.		II.		III.	
Cotton seed	2	lbs.	4	lbs.	4	lbs.
Simsim cake	1	"	1	"	Nil	
Crushed beans	1	"	$\frac{1}{2}$	"	Nil	
Crushed maize	1	"	1	"	1	lb.
Sorghum	0.33		0.16		0.25	
<i>Setaria</i>	0.33		0.16		0.50	
<i>Eleusine</i>	0.33		0.16		0.25	
Salt	0.04		0.04		0.04	
Lime	Nil		0.01		0.01	
Total	6	lbs.	7	lbs.	6	lbs.
Elephant grass	40	"	40	"	40	"
Total dry matter	15.08		16.04		15.12	
Digestible protein	1.57		1.77		1.39	
Total digestible nutrients	10.88		11.95		11.28	
Nutritive ratio	1:5.9		1:5.7		1:7.1	
Value	19.3	cts.	15.46	cts.	10.80	cts.

Ration I was changed to ration II owing to scouring: Ration II was changed to ration III primarily to reduce costs. Ration III was undoubtedly the most satisfactory and was used during most of the experimental period.

Analysis figures are based on Morrison's Tables, which may not be accurate for local conditions: the figures for elephant grass are particularly unreliable.

Stall-fed bullocks had the rations shown above, grazed animals had the same concentrates but no elephant grass. 50 lbs. of elephant grass were cut per day, and 10 lbs. is an estimate of wastage.

The feeding period was of 161 days' duration. During that period stall-fed bullocks made an average gain of 0.67 lb. per day (range 0.96 to 0.26) and the grazed bullocks an average of 0.76 lb. per day (range 1.09 to 0.61). The difference between the two groups is not significant.

Mr. Manning, Senior Botanist, kindly carried out an analysis of the liveweight gain figures comparing liveweight gain per week with duration of the experiment. He was able to show that the stall-fed bullocks attained their maximum rate of increase more quickly than the grazed.

Killing out-turn figures were obtained at the time of slaughter. Excluding the offal killing percentages were:—

Stall-fed	Average 49.7%	Range 47.8-51.4
Grazed	Average 49.3%	Range 46.3-52.6

Differences are not significant.

LABOUR COSTS

Labour costs are much the same in the two methods of treating with small numbers of cattle. With large numbers a herdsman could not cut elephant grass for as many cattle as he could herd.

CONCLUSION

In this trial liveweight gains put on by stall-fed and grazed cattle were much the same, though the stall-fed animals tended to get fat rather more quickly than grazed. In farming practice choice between

the two systems would depend upon amount of land available and labour; if small numbers are kept and land is valuable stall feeding is probably preferable; if large numbers are kept and land is cheap grazing would be the more economic method. This trial is being repeated.

22. Livestock—Pigs

Large black pigs only were kept during the year. Results were unsatisfactory. The majority of the sows which farrowed had little or no milk, and four litters had to be reared on cows' milk. A number of deaths occurred among both adult and young pigs. The cause was investigated by the Veterinary Research Officer, Entebbe, who believes that deaths were due to heavy *Bacillus coli* infestation.

23. Livestock—Poultry

Rhode Island Red fowls only were kept. Incubator results were poor during most of 1946. Part of the trouble was in the incubator, and better results have been obtained since a new one has been obtained. A high percentage of the eggs laid during part of the year were infertile. Recently better results have been recorded, though the reason for this infertility is not understood.

EXTENSION WORK

24. Kawanda Seed Farm

(a) COTTON INCREASE

259 acres of improved BP 52 were grown on the segregated area. The yield obtained was 136,603 lbs. of safi and 9,429 lbs. of fifi, *i.e.*, 564 lbs. per acre. The safi produced 43,130 lbs. of lint, a ginning out-turn of 31.6%.

Seed from this crop was examined by the Senior Botanist, who found that it contained a much lower percentage of black seeds than the general run of BP 52, and the seed has been sent to Bugerere for increase in the 1947–48 season.

(b) LAND TENURE

From the beginning of 1947 tenants on the Crown Land have started to pay rent according to amount of land occupied, the rate being Sh. 1 per acre. Each tenant is issued a licence which shows the amount of land occupied and the rent payable. The licence also contains certain stipulations for methods of cultivation and rotations.

(c) AMENITIES

A Rural Assistant took over the control of the Seed Farm in 1946 from an Assistant Agricultural Officer. He has run a small school for adults in the evenings. A number of tenants have also joined the recently formed Kawanda Social Club, and some of their wives attend the women's club run by the Social Welfare Department.

(d) MECHANICAL CULTIVATION

During recent months arrangements have been made for Seed Farm tenants to hire the Department's tractor and plough.

25. Ngogwe Livestock Improvement Area

The Agricultural Officer, Kawanda, is now assisting the Veterinary Officer, Kampala, with the agricultural side of experimental extension work in this Livestock Improvement Area. An experimental sub-station was opened at Kagongo near Ngogwe early in 1947. A Rural Assistant working under the Agricultural Department is in charge of agricultural activities. An article on this work has been submitted for publication in the *East African Agricultural Journal* by the Husbandry Committee.

Acknowledgment

This report includes references to a considerable amount of work which has been carried out in collaboration with Specialist Officers at Kawanda for whose assistance and co-operation I wish to record my appreciation. I also wish to acknowledge the ready assistance given in various livestock projects by Mr. H. G. Stewart, Provincial Veterinary Officer, Kampala, and Dr. Wilson, Senior Veterinary Research Officer, Veterinary Laboratory, Entebbe.

R. K. KERKHAM,

Agricultural Officer in Charge, Kawanda.

BEANS—KAWANDA

	Yields per acre						Palat- ability	Bean characters	Habit	Remarks	
	1943 Early (i)	1943 Late	1944 Early	1944 Late	1945 Early	1945 Late					
Mixed Mutike	..	..	..	357	533	..	1,915	..	325	Erect	Quick maturing
Mutike No. 2	..	70	163	..	350	424	..	..	..	Fair	Discarded
Mutike No. 3	433	..	310	..	350	..	..	..	..	Fair	Rather slow maturing
Mutike No. 4	578	..	1,168	590	1,646	..	2,101	1,342	850	Fair	Discarded
Bukelusa No. 1	462	..	467	471	904	..	..	..	..	Very good	
Bukelusa No. 2	..	..	..	286	775	263	570	380	55	Very good	
Banja ..	460	..	626	362	1,135	466	2,137	1,342	631	Very good	Very quick maturing
White Haricot	..	..	188	..	333	..	..	..	..	Not hard, popular	
Kagi ..	..	633	694	514	1,152	..	..	..	..	Not popular	
Kainja No. 1	597	..	594	343	952	..	..	..	..	Popular	Erect
Mugilugumunyo	354	..	467	..	967	..	..	..	..	Fair	Spreading
Namunyo	..	..	..	800	950	..	..	694	273	Fair	Spreading
Navy ..	..	210	118	..	1,017	..	..	..	..	Hard, not popular	Discarded
Rose coco	..	85	225	..	850	..	..	..	..	Hard, not popular	Discarded
Tepary ..	..	694	1,051	486	..	597	..	..	..	Hard, not popular	Very drought resistant
White Kidney	508	100	691	348	1,100	..	1,552	447	..	Popular	Spreading
Victory ..	..	785	838	395	1,035	..	..	..	..	Popular	Spreading
Gowa Kainja	524	..	215	..	..	..	..	..	..	Popular	Discarded

COFFEE COSTINGS

Plot size is 1.03 Acres but all figures expressed per acre

Plot No.	Treatment	Coffee yield clean coffee lbs. per acre				Coffee yield as percentage of mean annual yield				Value of Bananas		Value of Coffee		Total Value of Produce		Cultivation Costs (men-days)	
		1943-47		1943-44	1944-45	1945-46	1946-47	1943-47	1943-44	1946-47	1943-47	1946-47	1943-47	1946-47	1943-47	1946-47	
		1946-47	1943-47	1943-44	1944-45	1945-46	1946-47	1943-47	1943-44	1946-47	1943-47	1946-47	1943-47	1946-47	1943-47	1946-47	
1..	Spreading coffee; <i>Leucaena glauca</i> cover; No shade ..	11	673	14	5	65	13	44	..	..	3 30	213	3	213	125	1,024	
2..	Spreading coffee; Elephant grass mulch; No shade ..	91	2,370	159	315	104	109	155	..	..	27 30	1,317	27	1,317	41	1,015	
3..	Erect coffee; Elephant grass mulch; No shade ..	275	4,095	625	394	153	330	267	..	..	82 50	1,542	82	1,542	50	1,079	
4..	Spreading coffee; Coffee at 15' x 15'; Banana shade at 15' x 15' ..	15	585	13	2	57	18	38	10	131	4 50	179	14	310	82	854	
5..	Spreading coffee; Coffee at 20' x 20'; Banana shade at 10' x 10' ..	41	323	3	0	29	49	21	11	168	12 30	97	23	265	80	764	
6..	Same as plot 5, but with <i>Ficus</i> shade ..	21	165	0	0	15	25	11	28	193	6 30	63	34	234	85	779	
7..	Spreading coffee; Elephant grass mulch; <i>Ficus</i> shade ..	151	2,097	98	176	127	181	137	..	..	45 30	1,018	45	1,018	44	1,121	
8..	Spreading coffee; Clean weeded; <i>Ficus</i> shade ..	96	2,040	107	132	140	115	133	..	..	28 80	897	29	897	48	747	
9..	Spreading coffee; Clean weeded; <i>Albizia stipulata</i> shade ..	135	2,246	83	105	171	161	146	..	..	40 50	747	40	747	71	805	
10..	Erect coffee; Clean weeded; <i>Albizia stipulata</i> shade ..	65	2,819	170	148	208	78	184	..	..	19 50	1,063	19	1,063	87	614	
11..	Spreading coffee; <i>Leucaena glauca</i> cover; <i>Albizia stipulata</i> shade ..	18	320	2	1	31	32	21	..	..	5 40	99	5	99	133	929	
12..	Erect coffee; <i>Leucaena glauca</i> cover; <i>Albizia stipulata</i> shade ..	46	1,044	23	1	100	55	68	..	..	13 80	325	14	325	127	911	
13..	Spreading coffee; Elephant grass rows; <i>Ficus</i> shade ..	120	1,147	3	22	100	143	75	..	..	36 00	371	36	371	58	873	
	MEAN ..	83	1,532	100	100	100	100	100	..	..	..	..	..	..	..	..	

N.B. Plots 2, 3 and 7 were not mulched during the calendar year 1946-47.

(i) Values are given at market rates when sales were made.

(ii) Labour costs can be valued at Sh. 1/- per man-day.

GRAZING OBSERVATION PLOTS. BLOCK II. STRIP 9

Species	Grazing Days, 1946-47 per acre	Notes, March 1947
<i>Brachiaria decumbens</i>	412	Pure stand. Little <i>lumbugu</i> . Excellent ground cover.
<i>Chloris gayana</i> (Teso)	584	Pure stand. Little <i>lumbugu</i> . Good ground cover.
<i>Cynodon plectostachyum</i>	532	Poor stand. Much <i>lumbugu</i> . Good ground cover of <i>lumbugu</i> .
Natural regeneration	470	Mostly <i>lumbugu</i> and <i>Panicum trichocladium</i> . Fair ground cover.
<i>Echinochloa pyramidalis</i>	506	Pure stand in part. Little <i>lumbugu</i> . Good top cover, but not good bottom.
<i>Eremochloa ophiuroides</i>	448	Poor stand. Mostly <i>lumbugu</i> and <i>Imperata</i> . Fair cover.
<i>Setaria sphacelata</i>	468	<i>Setaria</i> tufts with <i>Panicum trichocladium</i> in between. Poor cover.
<i>Paspalum notatum</i>	420	Good stand. Not much <i>lumbugu</i> . Good cover.
<i>Pennisetum purpureum</i>	454	Poor stand. Some <i>lumbugu</i> and <i>Imperata</i> . Poor ground cover.
<i>Sorghum verticilliflorum</i> (Kavirondo <i>Sorghum</i>)	434	Poor stand. Some <i>lumbugu</i> and <i>Imperata</i> . Poor ground cover.

APPENDIX IV

Species	Method of Establishment	Grazing Qualities					Ease of ploughing out	Soil rejuvenating properties	Control of <i>Lumbugu</i>
		Competition with natural grasses	Persistence	Bulk	Palatability	Nutritive value			
<i>Brachiaria decumbens</i> ..	Sets only. Seed easy to collect but poor germination.	Good	Good	Poor	Good	Not known probably good	Good	Good	Good
<i>Chloris gayana</i> ..	Seed. Easy ..	Good	Good	Good	Good	Fair	Good	Good	Good
<i>Cynodon</i> ..	Sets only. Seed collection too difficult.	Poor	Fair	Fair	Fair	Good	Good	Good	Poor
<i>Echinochloa pyramidalis</i> ..	Sets. Seed not yet tried	Good	Good	Good	Fair	Unknown	Unknown	Unknown	Fair
<i>Eremochloa ophiuroides</i> ..	Sets. Does not seed here	Poor	Poor	Poor	Unknown	Unknown	Good	Unknown	Poor
<i>Setaria sphacelata</i> ..	Sets. Seed easy to collect but gives poor germination.	Fair	Good	Fair	Fair	Probably fair.	Good	Unknown	Fair
<i>Paspalum notatum</i> ..	Sets. Seed production low	Good	Good	Fair	Good	Probably good.	Bad†	Good	Fair
<i>Pennisetum purpureum</i> ..	Sets, but not expensive	Good	Poor*	Good	Good	Good	Bad	Good	Good
<i>Sorghum verticilliflorum</i> (Kavirondo <i>Sorghum</i>). ..	Seed. Easy ..	Good	Bad	Good to begin with.	Good	Unknown	Good	Probably fair.	Fair

N.B. * So far attempts to maintain a good stand of elephant grass under grazing have not been successful, but attempts are being continued.
 + *Paspalum* is easy to plough, but the "indigestion" effect after ploughing prohibits cropping for 3-6 months.

REPORT ON SERERE EXPERIMENT STATION

1. Meteorology

RAINFALL SUMMARY

Month	1946	Average 1921-45	1947
January ..	Nil	0.80	2.56
February ..	Nil	2.36	1.90
March ..	4.06	3.55	4.73
April ..	10.83	7.95	..
May ..	8.21	7.34	..
June ..	6.94	4.40	..
July ..	3.57	4.52	..
August ..	12.25	6.69	..
September ..	4.94	5.99	..
October ..	1.96	4.25	..
November ..	4.42	4.02	..
December ..	1.27	1.96	..
TOTAL ..	58.45	53.83	..

The complete absence of rain in January and February, 1946, caused the spring food crops to be rather later planted than usual although not so late as in 1945, and this is reflected in the crop yields. Other features were the very heavy rainfall in August and the absence of any appreciable dry season in 1946/47. On the whole the rainfall was well distributed although there was too much rain in those months, which normally comprise the dry season, for the successful ripening and harvesting of the cotton crop.

2. Experiment Farm

The position during the period under report was as follows :—

- Block A. Resting 2nd year, grazing continued.
- Block B. Resting 1st year, grazing continued.
- Block C. Resting 1st year, grazed (not required by Botanist).
- Block D. 1st year cultivation, cotton experiments.
- Block E. Resting 3rd year, grazing continued.
- Block Z. 2nd year cropping, food crop trials.

Continuing the policy adopted in 1944, on manure was applied to any of the blocks in 1946. Crop yields were good and the liveweight gains of the grazed cattle higher than anywhere else on the farm. This farm has now reached a high degree of fertility.

3. Old Farm

- Block 1. No change, resting.
- Block 2. Resting, supplies mulch and some elephant grass.
- Block 3. Grazing continued.
- Block 4. Permanent Manurial Experiment.
- Block 5. Resting, but now incorporated in the Main Farm on the Teso strip system.
- Block 6. Cropped with *Eleusine* and cotton.

- Block 7. *Cassia* continued.
- Block 8. Deferred grazing continued.
- Block 9. Grazing continued until December when ploughed for early cotton.
- Block 10. *Cassia* and oil palms.

4. Main Farm

Cropping was continued according to programme; for details see Crop Sections.

5. Cotton

The variety BP 50 B.A.R. from the 3 acre increase was grown on the Main Farm and on two strips of Block VI of the Old Farm. At the request of the Botanist different strips were planted at fortnightly intervals and superimposed in each strip were a series of observation plots again planted at different sowing dates, to investigate the incidence of *Lygus*. The main farm cotton was thus planted in what constituted a large-scale sowing-date-trial having as its object observations on the migration of *Lygus* from the early plantings to the later plantings. The results were not conclusive and will be included in the report of the Botanical Section.

There was comparatively little *Lygus* on the Main Farm and it is interesting to report that the early sowings planted in May practically escaped, whereas there was more Blackarm on the earlier than on the later plantings. The overall yield was 495 lbs. seed cotton per acre.

An average of 1.9 lesions per plant were found on BP 50 B.A.R. which compares with 1.6 lesions on B 181 which is known to be very resistant and further this difference is not significant.

The heavy rain in August (12.25 inches) was accompanied by much boll shedding but observations showed that comparatively little of this was due to Blackarm disease, and this variety will be further increased in the Mulondo segregated area in 1947 prior to general distribution. Although the rainfall in September was below average, rain fell in 19 days, and similarly the 1.86 inches recorded in October was spread over nine days. In November it rained on 13 days and the weather generally during this period was dull and overcast. In the opinion of the writer the low yield of cotton grown by farmers round Serere as compared with that from the Main Farm was due to the following reasons:—

- (1) Poorer cultivation, especially weeding.
- (2) Heavier incidence of Blackarm disease.
- (3) Failure to take advantage of such dry periods as there were to pick the cotton.

The incidence of cotton stainer was the heaviest yet recorded at Serere and for this reason the "close season" is being rigorously enforced and made as long as possible prior to planting the 1947 crop.

A cotton sowing-date trial was carried out on Block D of the Experiment Farm and will be reported on more fully by the Senior Botanist. The following is a summary of the results :—

TABLE 1

Sowing Date	Yield per Acre in lbs.	Remarks
20th May ..	849	Little <i>Lygus</i> damage. Blackarm moderate.
17th June ..	564	<i>Lygus</i> damage severe and Blackarm moderate.
15th July ..	498	Little <i>Lygus</i> damage. Blackarm fairly severe.

Other yields recorded were S 5302 (BP 50 BAR) 724 per acre, S 4105 (N 17 selection) 574 lbs., BP 52, 618 lbs., SP 84, 653 lbs., and B 181, 653 lbs. per acre. The superiority in yield of BP 50 BAR over S 4105 is important in that the former is now being increased in the Mulondo segregated area to replace the latter in South Teso Zone.

Depth of Cultivation.—A simple trial was carried out in duplicate on A1C to compare the following treatments :—

A = The plots were merely hand weeded and “shaved” with a hoe.

B = Normal ploughing with an E.C. plough.

C = Ploughed as deep as possible with a Howard’s Plough.

Results were as follows :—

A = 750 lbs., of seed cotton per acre.

B = 924 lbs., of seed cotton per acre.

C = 796 lbs., of seed cotton per acre.

On the plots under treatment A there was excessive growth of couch grass (*Digitaria scalarum*) as a result of which the land had to be heavily cultivated and cleared before *Eleusine* millet could be sown and this in turn has been followed by a heavy reversion to *Eleusine indica*—*vide* Section 6.

6. *Eleusine* (Finger Millet)

Owing to the delay in the onset of the rains the *Eleusine* crop was later planted than usual. This in itself was not serious but it meant that the bulk of the crop was harvested in July and early August. As it rained on 19 days in July and 22 days in August the drying of the crop was exceptionally difficult more especially as we have no covered drying floors at Serere as yet, although funds have now been made available for this purpose in 1947. Loss through germination was great in spite of having gangs of labour working double shifts turning the grain, and this is reflected in the somewhat poor yields. A total 43 acres were grown and the average over all yield was 1,579 lbs. per acre as compared with 1,325 lbs. in 1945. Strips 3 and 4 of Block VI Old Farm had to be resown and yielded only 315 lbs. per acre. Had the weather been satisfactory for the drying of this crop the yield would have been considerably greater.

The trial to compare the labour requirements for row planting as against broadcasting was repeated on D3E. Although the yields from both treatments were so low as to invalidate any useful com-

parison, weeding costs by themselves mean very little as the following table will show :—

TABLE 2

Treatment	Labour in Man/days per acre			Yield/acre in lbs.	
	Work Done	1945	1946	1945	1946
Broadcast	Sowing and digging in	Not recorded	10		
	Weeding ..	15	3		
	Thinning ..		Nil		
	TOTAL ..	?	13	2,094	785
Rows	Marking out and planting	Not recorded	33		
	Weeding ..	16	6		
	Thinning ..		8		
	TOTAL ..	?	47	1,512	975

It will be noted that the weeding costs in 1946 were in both cases considerably less than in 1945, this was due to the fact that the land was comparatively clean. In 1946 no thinning of millet sown broadcast was necessary.

Sowing by hand in rows is obviously uneconomic, and as a sowing machine suitable for planting *Eleusine* has not yet been designed it was decided in 1947 to use a "seeds barrow". This sowed the seed satisfactorily but in covering over the seed most of the "rows" were quickly lost. Another very strange phenomenon is that in the plot sown with the "seeds barrow" there is a large proportion of "Ekitu", i.e., *Eleusine indica*. The explanation of this is not yet fully known but this particular area of land was formerly under the "Shaving versus Deep Cultivation" trial (see Section 5) and owing to a rather heavy incidence of "lumbugu" (*Digitaria scalarum*) the field required to be ploughed previous to sowing *Eleusine* which is contrary to native practice, in other words this particular area of land received more than the usual amount of disturbance and the local inhabitants were quick to associate this with the amount of "Ekitu".

7. Sorghum

In the first rains sorghum was only grown for silage. 15 acres were grown which provided sufficient material to fill both pits. The silage was cut in the latter half of May and was ready for use in December. The quality was excellent and was much relished by the stock.

5 acres were grown in the second rains to maintain seed stocks and for pig food. The yield was only 389 lbs. (unthreshed heads) per acre.

8. Groundnuts

Yields were as follows (unthreshed nuts) :—

TABLE 3

Plot	Area	Variety	Planted	Harvested	Yield	Yields/acre
					lbs.	lbs.
A4C ..	1.03	B.227 ..	20-3-46	22-7-46	345	335*
A4C ..	1.88	Atuboi ..	20-3-46	22-7-46	238	127*
C4E ..	10.20	B.239 ..	18-3-46	1-7-46	11,110	1,089

* Damaged by wild pig and part of the crop stolen.

A good stand was obtained in all cases and the weather was quite satisfactory up to the time of harvesting. The fact that it rained on 19 days in July and 22 days in August and in the absence of any covered drying space, the difficulties of drying this crop can well be imagined and the resultant loss in drying was unavoidable. The variety B 239 although it is the only variety which yielded satisfactorily, is hardly worth growing under these conditions as it is extremely difficult to pick the nuts off the haulm. As usual some of the crop was stolen in spite of the posting of guards.

9. Sesame

Two acres of Kumam and Kamod were grown on the Main Farm in the first rains. Kumam gave 279 lbs. per acre which is about average, but Kamod gave only 108 lbs. per acre.

10. Maize

In 1945 practically all the maize grown on the Main Farm was stolen and in 1946 it was decided to grow this crop in the Introduction Area. Three varieties were grown namely Njoro White, Sahara Yellow and American Yellow (*ex* Busoga). Seed stocks were maintained.

11. Soya Beans

Five varieties were grown on the Main Farm but the only one to produce a crop was Black Soya which gave 285 lbs. per acre. Bad drying weather was responsible for the loss of most of the crop after harvesting due to sprouting.

12. Beans

Small plots of No. 26, Victory, Abundance and Canadian Wonder were grown in the first rains, but yields were disappointing. Victory with 180 lbs. and Abundance with 178 lbs. per acre were the best.

In the second rains some 20 acres were sown with Tepary beans and gave an average yield of 340 lbs. per acre. There was too much rain at the time of harvesting and there was some loss through germination.

Approximately 16 acres of Cowpeas were grown which gave a mean yield of 272 lbs. per acre. There was too much rain at the time of flowering for this crop and wet weather made drying difficult.

Other yields recorded in the second rains were Abundance 139 lbs., White Kidney 157 lbs., Victory 213 lbs., No. 26 102 lbs., and Haricot 190 lbs. per acre.

13. Peas

Quarter-acre plots of Alderman and Mauritius field peas were grown on B4W. Damage by birds was severe and some of the crop was stolen. Seed stocks were, however, maintained in the Introduction Area.

14. Cassava

Work on resistance to mosaic disease continued to be the responsibility of the Botanical Section and the main work centred round a long-term time of harvesting cum palatability cum mosaic

elimination trial which is now nearing completion. After 30 months in the ground only one-third of the varieties remained under trial.

On the Main Farm Nos. 7 37244E (Mbwa); 8 Aipin valunca; 11 F 279 (Mpologoma); 14 Kru; 15 Msitu and 43 Mkezumbe were grown in increase blocks for distribution in the districts served by this Station. No. 43 was only recently handed-over by the Botanical section for general increase. No. 11 is by far the most palatable of these varieties in that thieves stole the whole crop from this variety before condescending to start on any of the other plots and even went to the extent of stealing some of the planting material. There was a keen demand for planting material and all available supplies of Nos. 7, 8, 11, 14 and 15 were distributed to the Agricultural Officers in Busoga, Mbale and Karamoja Districts.

15. Rice

Three acres of Afaa were grown below the Atapar (impounded spring) and gave an average yield of 342 lbs. per acre. In spite of guards the depredations of birds were heavy as no rice is grown in the immediate neighbourhood, and also some of the crop was probably stolen. The plots nearest the Atapar yielded well but those furthest away suffered from lack of irrigation as the amount of water available is not sufficient for such a large area. Large numbers of *Anopheles* mosquito larvae were found in many of the plots and oiling had to be resorted to in the case of two small plots but even so the loss of crop was not excessive. Paris green applied as a dust at the rate of 1 lb. per acre appeared to have little effect on the larvae.

At Serere the cost of growing an acre of rice is approximately Shs. 80, therefore it is necessary to produce at least 800 lbs. per acre for this crop to pay. In 1945 the average yield was just over 1,000 lbs. per acre which showed a handsome profit.

16. Sweet Potatoes

Approximately 20 acres were grown on the Main Farm and gave a mean yield of 3,055 lbs. per acre. In spite of the absence of the usual dry season the late plantings yielded very little owing to heavy weevil damage. The indications were that damage by weevil is a seasonal factor and is not necessarily correlated with the onset of dry weather.

17. *Setaria Italica*

Although there is no local demand for this crop 1.60 acres were grown to provide food for poultry and pigs, and yielded 544 lbs. per acre. Variety S 7 with 923 lbs. per acre was the only one which gave a fair crop. All varieties suffered severely from bird attack.

Pure line selections were maintained by the Botanical Section.

18. Bulrush Millet (*Pennisetum*)

2.20 acres consisting of Awned and Acholi varieties were grown and although a good crop was set depredations by birds were such that the crop was not worth harvesting. The awned variety suffered just as much as did the Acholi variety which is not awned.

19. Pigeon Peas (*Cajanus indicus*)

On the recommendation of the Empire Cotton Growing Corporation 2 lbs. of Maghai Tur seed were obtained from Nagpur in India. One acre was planted in November in standing cotton at a spacing of 6 feet by 4 feet, *i.e.*, between every alternate row of cotton. Germination was good but even so 50% of the plants failed to survive what little dry weather there was and growth of the remainder was retarded. By the end of March, 1947, flowering had not yet commenced. The remainder of the seed will be broadcasted in standing cotton in July or August, 1947.

20. Miscellaneous Vegetables and New Introductions

The usual vegetables were grown to provide food for the many courses at Serere. In addition the following new or recent introductions were grown :—

Sahara Yellow Maize from Potchefstroom to maintain seed stocks for Karamoja.—Yielded 3,357 lbs. per acre (as cobs) and some crop was stolen. Seed was distributed to Kawanda, Gulu, Kitgum, Arua and Bunyoro.

American Yellow Maize (ex Kenya).—Practically whole crop stolen.

White Maize (ex Kenya).—Good crop, most of which was stolen.

Kabir Sorghum from A.O. Kitgum.—Yielded 2,570 lbs. per acre and is very promising.

Dwarf Sorghums—short term—ex Ukiriguru in Tanganyika.—Seed distributed to Karamoja. Seed stocks being maintained by the Botanical Section.

Seed of the following sweet sorghums was received towards the end of 1946 from the Plant Industry Station, Beltsville, Maryland: Sweet Sudan Grass, Tift Sudan Grass, Kansas Orange, Honey, Early Sumac, Chinese Amber, Atlas, Collier, White African, Sumac, Rex, Leoti, Caprok (grain sorghum) and Club (grain sorghum). The first twelve of the above list are presumably fodder grasses. All are now being grown on the Experiment Farm.

Panicum Millet.—Seed stocks maintained for Karamoja.

Sunflower.—Grew well, but no demand for seed.

“*Fiwi*” (*Dolichos lablab*) ex Mpwapwa.—Produced very little crop. Seed distributed A.O. Mbale and Kawanda.

Voandzeia subterranea eight types tried in second rains with little success, being tried again in 1947 first rains.

Desmanthus virgatus.—Used as a forage plant in Hawai. Seeds collected from the nursery beds and sown in Intermediate Grass Plots but failed to germinate. Will be tried again.

Styloanthus guinaneensis.—Transferred to Intermediate Grass Plots and growing in patches. Quite promising but subject to termite attack. Not yet grazed,

Pueraria phaseloides.—Another Legume obtained from the Provincial Agricultural Officer, Kampala, was planted in the nursery beds. Is now flourishing but no seed set as yet.

Glycine javanica from Mpwapwa.—Still surviving in Intermediate Grass Plots but dies back in the dry weather.

Echinochloa pyramidalis from Lango (Kawanda collection No. 20).—Doing well in the Intermediate Grass Plots. Liked by cattle.

Brachiaria mutica.—From Lango swamps. (Kawanda collection No. 8). only a few clumps remain—not yet grazed.

Panicum infestum from Mulondo. —Transferred from nursery beds to Grass Museum—Plot 45.

Upright Cowpeas from Potchefstroom.—Managed to collect 1½ lbs. of seed for increase.

Madagascar Bean from Kawanda.—Yielded only 80 lbs. per acre. Will be tried in second rains.

21. Orchards

All three orchards were manured and mulched as usual. The crop especially of grape-fruit, was not as good as usual.

22. Nurseries

The practice of transferring citrus seedlings from the nurseries to nursery rows at 4'×1' spacing was continued. The demand for seedlings, especially for oranges, greatly exceeded the supply. Seedlings issued in 1947 were as follows; the figures for 1946 being given for comparison :—

	1947	1946
Sweet orange ..	158	679
Grape fruit ..	350	239
Tangerine ..	300	248
Lemon ..	636	179
Lime ..	..	117
Marmalade orange ..	160	156
Avocado pear ..	166	14
Guava ..	30	37
Cashew nuts ..	195	28
Mulberry ..	214	39

The shortage of orange seedlings for distribution in 1947 was due to poor germination in the seed beds in 1945. A greatly increased supply will be available for distribution early in 1948.

23. Tree Planting

Owing to shortage of labour no more trees were planted except round the new Education Section, but those already planted were weeded and maintained.

SOIL CONSERVATION AND AGRONOMY

24. General

Under the present system of grass stripping and in the absence of any really heavy precipitation no appreciable erosion took place at Serere during the period under report.

25. Thorn Scrub Eradication

Mulondo.—In the latter half of 1946 a start was made with the experiments as outlined by the Thorn Scrub Committee at their meeting at Serere in April, 1945. Three 10-acre blocks were demarcated by means of fire-breaks for the following treatments :—

- (a) Burn early each year.
- (b) Burn late once a year.
- (c) Burn late once every three years.

Block (a) was burnt in October, 1946, when a reasonable burn was obtained. An attempt was made to burn Block (b) in February, 1947, but owing to the absence of the normal dry season it proved quite impossible to obtain any burn whatsoever. It was, however, learnt that the burning of really impenetrable thorn is impossible in the absence of any dry grass in the undergrowth, the thorn itself being very difficult to ignite. Burning therefore must be done before the thorn shades out the bottom grasses.

Serere.—The shortage of labour precluded any large scale investigation and such labour as could be spared was used to dig out thorn bushes in the many paddocks on the farm. Arrangements have been made for the "Burning" trials as outlined by the Thorn Scrub Committee in April, 1945, to be started in 1947.

26. Manurial Experiment—Block 4—Old Farm

This experiment, now being carried on as a "Museum specimen", was in the 2nd year of the 5th cropping cycle and was under sorghum followed by late cotton.

Yields in lbs. per acre were as follows :—

TABLE 4

			Sorghum	Cotton
Control	..	..	1,492	50
Lime	..	..	1,907	69
F.Y.M. 10 tons	..	..	2,252	331
20 tons	..	..	2,094	311
30 tons	..	..	2,709	413
Significance :—				
Linear	..	..	100:1	1000:1
Quadratic	..	..	..	100:1

As usual there was a strong linear response to Farmyard Manure ; 30 tons per acre gave eight times as much seed cotton as control, but even so yields were low.

27. Fertility Experiment

SUMMARY OF 1946. RESULTS:—

(a) In the case of May sown cotton on land in the first year of the third circuit (Cycle I) yields were generally good and as usual there was no response to farmyard manure applied four years previously.

(b) Cotton in the first year of the third circuit (Cycle I) for the first time showed a clear-cut response to length of resting period although there was no difference between two and three years' rest.

(c) Cotton following *Eleusine* in the second year of the second circuit (Cycle V) again gave a marked linear response to comparatively small doses of farmyard manure.

(d) Cotton following *Eleusine* again showed no response to increasing resting period.

(e) Cotton in the fourth year of the second circuit (Cycle III) again showed a marked response to manure applied two years previously.

(f) Groundnuts following cotton in the third year of the second circuit (Cycle IV) again showed a linear response (20:1) to manure applied the previous year, and a grass cover in the resting period gave a significantly higher yield than green manure.

(g) *Eleusine* in the second year of the second circuit (Cycle V) also showed a definite response to length of resting period but in this case three years' rest was better than two or one year's rest.

(h) Planted grass grazed gave a significantly higher yield of cotton (Cycle I), than ungrazed. Indications have been obtained on a number of experiments at Serere that crop yields are better after grazed grass than after ungrazed grass, but this is the first time that the comparison has been included in a lay-out capable of showing significance with relatively small differences.

(i) Sweet potatoes following groundnuts in the third year of the second circuit (Cycle IV) as usual showed a strong linear response to manure applied the previous year.

DISCUSSION

This experiment is now beginning to give interesting results on the cropping ratio whereas before, with a few minor exceptions, differences were confined to manurial treatments. Cycle I completed its second circuit (10-year period) in 1946 and the fact that only one year's rest (*i.e.*, two years' rest out of a total of ten years) gave a reduced yield compared with two and three years' rest is important and it now remains to be seen whether a two years' rest in a rotation of five years can maintain fertility.

Analysis of the combined results for all cycles shows that two years' cropping followed by three years' resting (2:3) and three years' cropping followed by two years' resting (3:2) both give much higher yields than four years' cropping followed by one year resting (4:1). The difference between 2:3 and 3:2 is significant though not so well marked. These results suggest that 3:3 should certainly be an efficient method of maintaining fertility under Serere conditions.

Much of the work at Serere during the past seven years has been designed to determine the effect of grazing the short leys and there is now sufficient evidence to state that grazing does not reduce the yields of subsequent crops, in fact, the indications are that grazing actually increases yields. The fact that in cycle I the highest yield of cotton

(733 lbs. per acre) was obtained from the grazed plots supports these findings (see section 35 for further results).

28. **Cotton Seed and Ash Experiment** was opened up in 1947 after three years' resting and sown with *Eleusine* to determine any residual effects.

29. Phosphatic Manurial Trials

Two manurial trials were laid down in the period under report :—

(a) TO COMPARE THE EFFECT OF DIFFERENT LEVELS OF ROCK AND SILICO PHOSPHATE WITH AND WITHOUT NITROGEN ON ELEUSINE.

The experiment formed one of a series of experiments carried out in Teso District, the design for which was drawn up by the Acting Senior Botanist. Altogether there were five centres and the results were analysed as a randomised complete block design with ten replications (*i.e.*, two at each locality). No locality $\times$ treatment interaction was evaluated for this preliminary trial, and the main fertilizer effects were computed ignoring locality differences to ascertain the differences of the overall response.

The result at Serere was as follows :—

TABLE 5
YIELDS IN LBS. DRIED HEADS PER ACRE

Manure	No Nitrogen	With Nitrogen
Rock Phosphate (1) ..	2,363	2,590
Rock Phosphate (2) ..	2,853	2,870
Silico Phosphate (1) ..	2,380	2,993
Silico Phosphate (2) ..	2,415	3,115
Control No Manure ..	2,041	..

Rock phosphate	(1)=280 lbs. per acre.
Rock phosphate	(2)=560 lbs. per acre.
Silico phosphate	(1)=280 lbs. per acre.
Silico phosphate	(2)=560 lbs. per acre.
With Nitrogen	=224 lbs. Sulphate of Ammonia per acre.

DISCUSSION

The results show that without nitrogen the phosphate has given a 13% increased yield over all centres and the addition of nitrogen increased the yield up to 56%. The Acting Senior Botanist who was responsible for the lay-out and the analysis of variance reports as follows: "From the analysis of variance it will be seen that nitrogen exerts an effect of overwhelming magnitude and that the effects due to phosphates are of lower magnitude than those due to nitrogen. With regard to the significance of the silico *versus* rock phosphate it is apparent that the greater part of the difference can be attributed to the comparison of the two phosphates at the lower level. The response of the silico-phosphate can presumably be attributed to its greater solubility. There is, however, some evidence that 2 cwts. of silico-phosphate does not lead to a yield increase over the 1 cwt.

application. Further, though 1 cwt. silico-phosphate is at least as good as 2 cwt. of rock phosphate, the question of their relative suitability becomes rather an economic than experimental problem."

A further series of trials on *Eleusine* using 3×3 lay-out with interactions partially confounded were laid down at different centres including Serere early in 1947, but the results are not yet available.

(b) N.P.K. EXPERIMENT—BLOCK 6—OLD FARM

Object.—To determine the effect of different levels of Sulphate of Ammonia, Silico-Phosphate (special Mix.) and Sulphate of Potash alone and combined on cotton grown in the normal Serere rotation.

Layout $3 \times 3 \times 3$ Variety with interactions partially confounded.
Treatments :—

No	=No Nitrogen
N1	=112 lbs. Sulphate of Ammonia per acre
N2	=224 lbs. Sulphate of Ammonia per acre
Po	=No Phosphate
P1	=112 lbs. Silicophosphate (Special Mix)
P2	=224 lbs. Silicophosphate (Special Mix)
Ko	=No Potash
K1	=112 lbs. Sulphate of Potash per acre
K2	=224 lbs. Sulphate of Potash per acre

RESULTS

Yields expressed in lbs. total seed cotton per acre :—

TABLE 6

			No	N1	N2
Po	..	..	645	649	723
P1	..	..	631	716	759
P2	..	..	702	717	864

TABLE 7

			No	N1	N2
Ko	..	..	634	693	787
K1	..	..	696	668	742
K2	..	..	648	721	817

TABLE 8

			Po	P1	P2
Ko	..	..	650	707	757
K1	..	..	643	679	784
K2	..	..	724	720	747

DISCUSSION

The analysis of variance showed that there was a strong positive linear response to Nitrogen (1000:1). and a positive linear response to Phosphate (100:1). None of the interactions were significant. A further experiment has been designed for 1948 to test out the effect of different levels of Silico-phosphate with and without different levels of nitrogen in order to get a better measure of the interaction effect if any.

GRAZING AND GRASS TESTING

30. Farmyard Manure versus Dropped Trial

The trial continued in its sixth year in two sections. P1-5 were in the third year of cropping and were under sweet potatoes and P11-15 were in the third year of rest, having been cropped from 1941-45.

Treatments are (one acre paddocks) :—

- A. P.1 and P.12. Grass cut for bedding on P.12 for two beasts which are kept in a kraal and the manure applied to P.1. Grass for food cut on a separate pasture.
- B. P.2 and P.14. Grass cut for bedding on P.14 for two beasts which are kept in a kraal at night only. Manure applied to P.2. Cattle graze during the day on a separate pasture.
- C. P.3 and P.13. One beast grazed day and night on P.13 (on P.3 during the previous three years)
- D. P.4 and P.15. Two beasts graze on P.15 during the night. Graze on separate pasture during the day (on P.4 during the previous three years).
- E. P.5 and P.11. Two beasts graze on P.11 during the day. Graze on a separate pasture during the night (on P.5 during the previous three years).

In treatments A and B grass is used for production of manure. In treatments C, D and E it is used for grazing in the field.

(a) P1-5 CROP YIELDS

In 1944 these plots were split into two halves and one half cropped with cotton and the other half with *Eleusine* followed by cowpeas.

TABLE 9

Plot	Treat- ment	Cotton 1944/45	<i>Eleusine</i> 1944	Cowpeas 1944	Ground- nuts 1945	Tepary Beans 1945	Sorghum 1945	Sweet potatoes 1946
P1 ..	A	321	1,929	328	1,498	275	2,770	6,791
P2 ..	B	484	1,441	361	1,445	239	2,022	4,015
P3 ..	C	429	1,156	396	1,534	244	1,989	5,122
P4 ..	D	453	1,555	366	1,087	247	2,044	5,219
P5 ..	E	390	1,261	414	827	202	1,557	7,419

Cotton yields in lbs. seed cotton per acre.

Eleusine yields in lbs. dried heads per acre.

Cowpeas yields in lbs. grain per acre.

Groundnut yields in lbs. unshelled nuts per acre.

Tepary beans yields in lbs. grain per acre.

Sorghum yields in lbs. dried heads per acre.

Sweet potato yields in lbs. fresh tubers per acre.

In 1943/44 season the cattle were removed in February.

In 1944/45 season the cattle were not put in until June.

In 1945/46 season the cattle were put in in April and there was sufficient grass on P12-15, but those on P11 had to be taken out on the 11th January, 1946, and were not put back until March. All cattle were given 2 lbs. of cotton seed per day during the dry season.

1946/47 season. There was again sufficient grass on P12-15 but the cattle on P11 had to be taken out for three periods as follows :
 (i) from 15th July to end of August ; (ii) 24th October to end of year ;
 (iii) 3rd January to 13th March.

(b) P11-15 CATTLE LIVELWEIGHT GAINS COMPARED WITH P1-5

TABLE 10
YEAR=APRIL TO MARCH

Treat- ment	Plot	Bullock	1941-42	1942-43	1943-44	Plot	1944-45	1945-46	1946-47
A	P1 ..	(i) .. (ii) .. Total ..	WEIGHBRIDGE NOT IN USE	116 94	-12 100	P12 ..	-9 -28	168 112	227 257
				210	88		-37	280	484
B	P2 ..	(i) .. (ii) .. Total ..		94 93	153 154	P14 ..	137 123	145 207	182 192
				187	307		260	352	374
C	P3 ..	(i) ..		177	108	P13 ..	76	161	167
D	P4 ..	(i) .. (ii) .. Total ..		195 169	123 113	P15 ..	142 149	186 169	196 194
				364	236		291	355	390
E	P5 ..	(i) .. (ii) .. Total ..		142 141	92 64	P17 ..	122 167	203 117	168 186
				283	156		289	320	354

DISCUSSION

At this stage it is still impossible to analyse the results statistically, and even if it were possible to do so it is doubtful whether any useful result would be so obtained as this year's results have made it abundantly clear that when working with very small cattle populations very much depends on the health of the individual animal. *e.g.*, in the case of the two animals in the kraal all the time (treatment A) it is very difficult to reconcile a mean loss of $18\frac{1}{2}$ lbs. in 1944/45 with a mean gain of 242 lbs. in 1946/47. This mean gain of 242 lbs. is probably the highest ever recorded at Serere and it is clear that we must reconsider our opinions as to stall feeding *versus* grazing in the case of "butcher" cattle.

(ii) In the period under report the liveweight gains were the highest yet recorded in this trial for all treatments due, no doubt, to the favourable rains. The highest liveweight gains were made during the months of January to March, 1947, which is explained by the fact that there was no dry season this year, and the worst months were August (12.25 inches of rain) and November (4.42 inches).

(iii) There is again no consistent difference between cattle kept outside day and night (treatments C, D and E) and those sleeping in a kraal at night and grazing outside during the day (treatment B).

(iv) The results again confirm that cattle do very little grazing at night, *i.e.*, there was always more than enough grass on P 15 (night grazing only) for two animals whereas the cattle on P11, day grazing only had to be removed on three occasions during the year due to insufficient grass.

(v) As regards the yields of subsequent crops following these grazing treatments which is the real criterion of the experiment, Table 11 would tend to show the advantage of applying farmyard manure to the land. The high yield of sweet potatoes on P 5 (treatment E) is, however, difficult to account for. The preparation and planting of these 5×1 acre plots took an appreciable time and plot No. 5 was the last to be planted by which time more and better planting material was available.

31. Deferred Grazing—Old Farm

Block 8 was closed for most of 1946 and was opened for grazing in January, 1947. Blocks 3 and 9 and P 22 were all grazed rotationally by an average of 14 head of cattle.

32. P 54-56

These three 5-acre paddocks continued to be grazed on a deferred system and P54 was closed in 1946 up to 10th September when the grazing available was insufficient to carry all the young stock required which varied from 16 to 22 head. Liveweight gains were so poor that it was decided to add an additional 5-acre paddock No. 56 B which was opened to grazing in March, 1947.

33. No-Light-Heavy Grazing Trial—B6E, B6C, C1C, C1E and C3E

The position in 1946 was as follows :—

P 16-21. Laid down in 1940. In the second year of cropping under *Eleusine* followed by Cowpeas or Sorghum.

P 36-41. Laid down in 1941. In the first year of cropping under cotton.

P 48-53. Laid down in 1942. In the first year of cropping under cotton.

P 57-62. Laid down in 1943. In the third year of grazing—opened for cotton in 1947.

Yields recorded so far in this trial are as follows :—

TABLE 11

Plot	Treatment	Cotton 1945/46				<i>Eleusine</i>	Cowpeas	Sorghum
		Safi per acre	Fifi per acre	Total Seed Cotton	Fifi	1946	1946	1946
		<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	%	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>
P16 ..	No Grazing ..	332	52	384	13.5	1,528	..	736
P17 ..	Heavy Grazing	472	64	536	11.9	1,828	..	930
P18 ..	Light Grazing	458	62	520	11.9	1,678	..	742
P19 ..	Light Grazing	444	62	506	12.3	1,614	336	..
P20 ..	Heavy Grazing	384	84	468	17.9	2,014	318	..
P21 ..	No Grazing ..	366	66	426	15.5	2,092	292	..

TABLE 12

Plot No.	Acres	Treatment	Safi per acre	Fifi per acre	Total Cotton per acre	Fifi
			<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	%
P36 ..	0.5	Light Grazing ..	780	76	856	8.9
P37 ..	0.5	Heavy Grazing ..	542	68	610	8.8
P38 ..	0.5	No Grazing ..	618	96	714	13.4
P39 ..	0.5	No Grazing ..	546	98	644	15.2
P40 ..	0.5	Light Grazing ..	480	78	558	14.0
P41 ..	0.5	Heavy Grazing ..	514	58	572	10.1
P48 ..	0.5	No Grazing ..	438	42	480	8.8
P49 ..	0.5	Light Grazing ..	534	44	578	7.6
P50 ..	0.5	Heavy Grazing ..	552	36	588	6.1
P51 ..	0.5	Heavy Grazing ..	336	46	382	12.0
P52 ..	0.5	No Grazing ..	280	20	300	6.7
P53 ..	0.5	Light Grazing ..	268	20	283	6.9

TABLE 13

SUMMARY OF ABOVE RESULTS IN LBS. PER ACRE

Treatment			Cotton		<i>Eleusine</i>	Cowpeas	Sorghum
			1945/46	1946/47	1946	1946	1946
No Grazing ..	..	..	405	535	1,810	292	736
Light Grazing ..	..	..	502	570	1,646	336	742
Heavy Grazing ..	..	..	513	538	1,921	318	930

TABLE 14

NGETTA AND SERERE RESULTS COMBINED

Treatment			Cotton	<i>Eleusine</i>
No Grazing ..	..	..	477	1,980
Light Grazing ..	..	..	515	2,160
Heavy Grazing ..	..	..	551	2,321
Significance ..	..	..	Nil	Nil

Light grazing = 1 beast per 2 acres.

Heavy grazing = 1 beast per acre.

DISCUSSION

In the combined statistical analysis of the combined results from Serere and Ngetta in respect of Cotton and *Eleusine*, grazing was not significantly better than no grazing, although in the case of *Eleusine* the difference just failed to be significant. In these trials half the plots were originally sown with *Chloris gayana*, and the other half consisted of natural regeneration. In the case of both Cotton and *Eleusine*, *Chloris* gave the highest yields but the difference was not significant. The results, however, confirm the results of other experiments at Serere in that grazing does not reduce the yields of subsequent crops, and in most cases careful grazing will increase yields. The experiment continues.

34. Rotational Grazing Trial—C6E Main Farm

For details of this trial the report for the year ended 30th June, 1946, should be referred to. In 1946 all six plots were under *Eleusine* following cotton and results were as follows :—

TABLE 15

Plot No.	Treatment	Yield Cotton per acre in lbs.	Yield <i>Eleusine</i> per acre in lbs.
P42 ..	Grazed by tethered cattle in the day only, starting in the first year of rest	758	1,996
P43 ..	Continuous grazing started in the first year	694	2,050
P44 ..	No grazing	567	1,573
P45 ..	Rotational grazing 30-day cycle with two sections. Grazing started in the first year	631	1,850
P46 ..	Continuous grazing started in the second year	490	1,842
P47 ..	Rotational grazing 60-day cycle with two sections started in the first year	489	1,305

DISCUSSION

Although the results of this trial tend to confirm the fact that yields after a grazed ley are higher than after ungrazed grass a marked fertility trend has prevented smaller differences between the different methods of grazing being detected and the trial has been abandoned in its present form and site.

35. Quarter-Acre Grass Plots

The results from these grazing and grass testing plots have unfortunately been overshadowed by a marked fertility gradient which has completely masked any differences due to the seed mixtures. Even so some valuable information has been obtained on the palatability of the different grasses and their carrying capacity. The results may be summarised as follows :—

(1) We have yet to find a grass or mixture of grasses which will stand competition from local grasses without weeding.

(2) Sooner or later the plots revert to the same mixture of grasses as one would get with natural regeneration which at Serere means mainly *Cynodon plectostachyum* on good land with some *Panicum* maximum in the first year followed by *Imperata*, *Sporobolus* and lesser amounts of *Hyparrhenia* and *Setaria* in subsequent years.

(3) *Imperata* (Lusenke) is a good index of soil fertility—the more “lusenke” the more fertile the soil.

(4) The most promising grasses are *Chloris gayana*, *Cynodon plectostachyum*, *Cenchrus ciliaris*, *Melinis minutifolia*, *Bothriochloa glabra* and *Bothriochloa pertusia*.

(5) Grazed plots nearly always have a good *Cynodon* bottom with some *Paspalum commersonii*.

(6) All the mixtures so far, with few exceptions have carried four beasts to three acres under a system of rotational grazing.

(7) For future work it is considered that at least two cleaning crops should be taken prior to laying down any pasture, and the

area round the paddocks kept slashed to reduce the incidence of local grasses noticeably *Imperata* and *Sporobolus*.

(8) Grazing increases the amount of *Cynodon plectostachyum*.

(9) The difficulty experienced in other countries of eradicating *Cynodon* when the land is cropped has been overcome at Serere by close grazing prior to opening up.

36. Grass Museum

This was maintained. No new introductions were sown.

37. Hedging Trials

There is little to add to my last report. All hedges have been maintained but none can be said to be really cattle-proof. The most promising are Mauritius Thorn (*Caesalpinia sepiaria*) and *Aberia Gardnerii*. The lateral spread of Mauritius thorn can be prevented by drastic pruning using a heavy stick. New introductions included *Malphigia glabra*, Pomegranate and *Euphorbia cuneata* which were planted in the nursery beds. Unfortunately, all succumbed to white ants.

LIVESTOCK

38. Bulls

The two stock bulls—Katerega (L.6) and Oula (L.71) continued to run with their respective herds. We are now beginning to get sufficient heifers from these two bulls to carry out progeny tests. It is proposed to lend Oula to Ngetta and to replace him by Kyobe a young bull by Katerega out of Akwazo.

Three young bulls were sold including one to the Veterinary Officer for Amuria Prison Farm. There is now a long waiting list for Serere bulls.

On the advice of the Animal Husbandry Committee a third "free range" herd was started and consisted of the bull Badcock and all cows which had failed to give 50 gallons by the 4th lactation.

39. Cows and Heifers

There were 84 cows and heifers as at the 1st January, 1946. Seventeen young heifers were brought in making a total of 101. Of these five were slaughtered and one young heifer was taken by a leopard leaving a balance of 95 at the end of the year and since when five heifers have been sold to Veterinary Department, Entebbe.

40. Working Herd

At the end of 1946 the working herd consisted of 95 animals and in addition there were 33 on the various grazing experiments.

41. Calves

There were 46 calves at the 1st January, 1946. There were 56 births making a total of 102. Of these two were killed by leopards and seven died. Of the deaths only two or three were due to East Coast Fever. This is probably the lowest on record. All calves normally get E.C.F., and the reduction in the number of deaths is undoubtedly due to early

treatment with M & B 693. This drug is presumed to prevent secondary infection with pneumonia which in many cases is believed to be the ultimate cause of death. The "Free range" made the best liveweight gains, followed closely by the bucket fed calves.

42. Milk Production

A total of 4,783 gallons were produced of which 3,104 were sold. 118 lbs. of butter and 36 lbs. of ghee were made and the balance of the milk was fed to calves or issued free as rations. The best milker for the year was again Akwazo with 235 gallons with calf at foot. Her previous best was 198 gallons. Ten out of seventeen cows tried have now been trained to let down their milk without the calf. Of these, the best yield was from Apecho II with 242 gallons in her first lactation.

Milk records for 1946 show the following grouping :—

						No. of Cows
Over 200 gallons in one lactation	..	..	..	..	..	2
" 190 "	"	"	"	"	"	..
" 180 "	"	"	"	"	"	1
" 170 "	"	"	"	"	"	1
" 160 "	"	"	"	"	"	1
" 150 "	"	"	"	"	"	3
Between 100 and 150 gallons in one lactation	..	..	..	..	..	16
" 50 " 100 "	"	"	"	"	"	11

43. Liveweight Gains

During the period under report liveweight gains were on the whole very satisfactory. The steers and heifers on the Experiment Farm did exceptionally well as did the steers on the Main Farm. Given a plentiful supply of grass without excessive moisture, gains of up to 1 lb. per head per day can be obtained.

A start has now been made with feeding simsim cake and maize meal to bucket fed calves as a substitute for whole milk and the calves are making better liveweight gains than those at foot.

Since 1942 all animals bred on the farm have been weighed monthly and from these weighings the average weight at each month of age has been calculated and the results plotted on a graph. This graph shows quite clearly that for Zebu cattle under Serere conditions males reach maturity at from 65 to 68 months of age and females at 40 months. As far as females are concerned maturity coincides with the first calving down. The weights at maturity are :—

Males	= 800 lbs. (approximately)
Females	= 550 " "

At no time do the females weigh heavier than the males although there is comparatively little difference in weights during the first year of life.

Although it can be assumed that all calves at Serere are attacked by East Coast Fever during the first six months of life the graphs do not record any appreciable loss in condition during that period.

44. Pigs

The pig herd was maintained ; 21 piglets were born, of which only nine survived. From time to time and usually during the dry weather,

a disease attacks the young pigs which die in the matter of a few hours. Numerous post-mortems were carried out by an Officer of the Veterinary Department but the cause of the disease is still unknown.

45. Small Stock

A few sheep, goats and poultry were maintained for demonstration purposes for the benefit of the many students at Serere. It has now been decided to concentrate on Rhode Island Red poultry and a breeding pen of one cockerel and ten pullets was obtained from Kenya, and from which 34 chickens have been raised to date.

MISCELLANEOUS

46. Grain Silo

This silo which contains 40 tons of *Eleusine* grain was opened and examined by the Entomologist in December and except for slight superficial damage to the grain beneath the man-hole cover due to seepage of rain, was found to be in good condition.

47. Atapar

This continued to provide an ample supply of water for all the stock.

48. Labour

The supply of labour continued to be precarious especially from June to August. There are very few resident labour and we are largely dependent on local residents who naturally require to work on their own farms at the time when we need them most. An attempt was made to recruit labour from Usuku (North Teso) but the men disliked being away from their own homes and soon left. A start was made on the erection of 12 houses for labour each house to accommodate three bachelors or one married couple. Six of these houses are nearing completion.

49. Buildings

In addition to work on the new labour lines, a workshop, large implement shed, store for the Education Section and two large drying floors were completed. The work of maintenance continues to increase and several semi-permanent houses were re-roofed and repaired. It is not unusual at Serere to have up to 40% of the available labour engaged on station maintenance and building work as so many of the buildings are of a temporary nature. 100,000 bricks were made at a cost of Shs. 20 per 1,000.

50. Water Supplies

In February, 1947, a very successful borehole (1,440 gallons per hour) was sunk on the western boundary by the Geological Department and a plentiful supply of water is now assured. An additional storage tank for 20,000 gallons was completed on Kakudoma hill by the Public Works Department, and a pipe line was laid to the Education Centre.

51. Revenue

Revenue in 1946 amounted to Shs. 14,934 as compared with Shs. 11,216 in 1945.

52. Education

In 1946 this section was primarily engaged on courses for ex-askaris, during which period 234 ex-askaris completed the six weeks' course. In February this Department assumed complete control of the Civil Reabsorption Centre at Serere. Three Makerere students completed their 4th (practical year) at Serere and others who attended courses were : Apprentices 11, Vernacular Teachers in Training 52, Chiefs and Cultivators 204, and Prison Warders 7.

53. Acknowledgment

I acknowledge with grateful thanks the help of Messrs. Manning and Kerkham in the analysis of the more complicated experiments and the new factorial designs for the various phosphatic manurial experiments laid down in the period under report.

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Agricultural Officer in Charge, Serere.

REPORT ON PASTURE WORK—NGETTA FARM

(a) GRASS GRAZING TRIAL (1941)

This trial, which is situated in Block V was planted with groundnuts followed by short term sorghum (Awera) during 1946, this being the third year of cropping. Yields per acre in pounds of unshelled groundnuts were :—

Treatment		<i>Cynodon</i> spp.	<i>Chloris gayana</i>
Heavy Grazing	..	2,101	1,563
Light Grazing	..	2,078	2,384
No Grazing	..	1,904	1,939

Yields of sorghum in pounds per acre of dried unthreshed heads were :—

Treatment		<i>Cynodon</i> spp.	<i>Chloris gayana</i>
Heavy Grazing	..	2,416.30	2,534.1
Light Grazing	..	2,237.7	2,861.8
No Grazing	..	2,348.2	2,431.7

(b) GRASS GRAZING TRIAL (1942)

This is a replication of the above trial. It was laid down in Block VI in 1942 and ploughed up in early 1945. During the year of cropping the following yields per acre of dried unthreshed heads of *Eleusine* were obtained :—

Treatment		<i>Cynodon</i> spp.	<i>Chloris gayana</i>
Heavy Grazing	..	2,310	2,678
Light Grazing	..	1,819	2,441
No Grazing	..	1,675	2,084

When the experiment has been completed these results will be included in a composite report, but it will be seen from the above that in both trials the indications are that *Chloris* is a rather better regenerating grass than *Cynodon*.

(c) GRASS VARIETY SEED-RATE AND SOWING DATE OBSERVATION PLOTS (1943) BLOCK I.

The grass plots were ploughed in May, 1946, and the following yields per acre of cotton (all grades) were obtained :—

			Early Sown	May Sown
<i>Chloris gayana</i> seeded 16 lbs./acre	..	..	962.1	1,149.5
<i>Chloris gayana</i> seeded 24 lbs./acre	..	..	947.6	1,109.8
<i>Brachiaria decumbens</i> planted 2' x 1'	..	..	1,071.5	1,062.7
<i>Brachiaria decumbens</i> planted 1' x 1'	..	..	1,041.0	969.4

(d) GRASS GRAZING TRIAL (1944) BLOCK II

This trial was designed to test the effect of *Grazing* and *No Grazing* on regenerating land. The grass treatments are : (1) *Natural Regeneration* ; (2) *Chloris gayana*, and (3) *Brachiaria decumbens*. There are

two half-acre plots under each treatment, one grazed and the other left ungrazed. This experiment has now passed through its three years' regeneration period, and the land will be ploughed for cotton in 1947.

The ungrazed plots contain the usual rank growth. The *Brachiaria* maintained an excellent cover throughout. At the time of writing these plots contain very few weeds, being almost a pure stand of *Brachiaria*. The *Chloris* plots have become very weedy and a considerable amount of *Sporobolus* sp. has appeared. This is also true of the natural regeneration plots.

(e) GRASS GRAZING TRIAL (1945) BLOCK III

This is the second part of the previous trial and was laid down in Block III in 1945. All grasses have established themselves well and the soil cover is good, especially high marks going to the *Brachiaria*. It is doubtful whether this latter grass can really be considered for temporary leys in view of the expense of planting. Should permanent pasture be required *Brachiaria* might prove of great value.

(f) GRASS GRAZING TRIAL (1946) BLOCK IV

This is the third part of the 1944 trial. Grazing commenced in April, 1947. All grasses have established themselves well.

(g) GRASS VARIETY OBSERVATION PLOTS (1946) BLOCK IV

In these plots *Chloris gayana* is compared with *Hyparrhenia rufa* and *Brachiaria decumbens*. All the grasses have done well especially *Hyparrhenia*, which produced a large bulk of herbage. It was also noticeable that it was very palatable to stock even when old. The *Hyparrhenia* plot was six to seven feet high when grazing commenced in late March but despite this it was rapidly eaten down and after three weeks contained less herbage than either of the other two plots. Ground cover and distribution of production given by this grass are, however, poor.

Stock Carrying Capacity at Ngetta

The fixed herd of 22 mature bulls and bullocks was maintained on rather less than one acre per head. The dry season was much less severe than usual and the animals remained in good condition throughout the year, except for a slight falling-off in March. During the dry season about 1 lb. of cotton seed was fed per head per day.

Ngetta Soil Exhaustion Plot

This plot has been cultivated continuously since 1928. The yield of wimbi this year was 641 lbs. per acre of dried heads compared with 1,786 lbs. in Block VI. The low yield is largely accounted for by the poor germination.

R. P. DAVIDSON,

Provincial Agricultural Officer, Northern Province

EASTERN PROVINCE

REPORT ON BUGUSEGE COFFEE EXPERIMENTAL STATION

1. Arabica Coffee

(a) 1932 PRUNING AND SPACING EXPERIMENT

YIELDS IN CWTs. OF FRESH CHERRY PER ACRE

1946	8'×8'	7'×7'	6'×6'	4'×4'	Means
Unlimited Terminal Growth ..	27.84	33.30	20.31	26.43	26.97
Modified Multiple Stem ..	26.59	50.96	49.54	35.58	40.67
Total to Date					
Unlimited Terminal Growth	441.54	439.68	482.72	630.42	498.59
Modified Multiple Stem ..	415.51	491.31	466.50	470.42	460.94

The modified Multiple Stem treatments gave a mean yield approximately the same as that of the previous year (43.66 cwt. per acre) whereas the Unlimited Terminal Growth produced a much heavier crop (79.24 cwt. per acre) in 1945.

A feature of the 1946 crop was that whereas picking on the Modified Multiple Stem treatments took place from June to December that of the Unlimited Terminal Growth began in October and was completed in December.

As in the previous year, samples were taken from the whole crop for each treatment for liquoring and valuation with the following results :—

Shs. 126 ..	M	M	S	7'×7'
	U	T	G	6'×6'
	M	M	S	6'×6'
	U	T	G	4'×4'
Shs. 121 ..	M	M	S	8'×8'
	U	T	G	8'×8'
	U	T	G	7'×7'
	M	M	S	4'×4'

Once again, the actual value bears little relation to the treatments.

In 1945 the commercial report showed no definite trends between treatments as regards damage by pests, but this year whilst there was no difference attributable to *Stephanoderes* there was a definite increase in *Antestia* damaged beans with closer spacings, the greatest damage being in the 4'×4' U.T.G. and the least in the 7'×7' M.M.S. The close proximity of the treatments is, however, likely to mask results of this nature, but an examination of beans made by the Entomologist, towards the end of the season confirms these results.

Treatment		% <i>Antestia</i> damaged beans	% <i>Stephanoderes</i> damaged beans
U.T.G. ..	8'×8'	17.9	15.3
	7'×7'	19.7	22.3
	6'×6'	20.2	35.2
	4'×4'	28.8	25.9
M.M.S. ..	8'×8'	9.3	34.0
	7'×7'	8.6	32.7
	6'×6'	9.5	26.3
	4'×4'	15.2	17.1

The figures show markedly greater damage by *Antestia* in the Unlimited Terminal Growth treatments and in both types of pruning attack increases with closer spacing. *Stephanoderes* damage does not appear to be related to treatments.

(b) 1936 SPACING, STUMPING AND UPROOTING EXPERIMENT
YIELDS IN CWTs. OF FRESH CHERRY PER ACRE

1946		3'×3'	4'×3' 9"	5'×5'
Uproot alternate rows	..	10.29	9.76	6.31
Stump alternate rows	..	0.62	0.21	12.64
Total to date				
Uproot alternate rows	..	227.39	197.39	219.84
Stump alternate rows	..	201.60	227.67	221.19

Trees in the "uproot alternate rows" treatments were uprooted in 1939 (4'×3' 9" and 3'×3') and in 1945 (5'×5') and the trees are now spaced at twice the above spacing. Trees in the "Stumping" treatments were all stumped in 1943 and again in 1946 (except in the 5'×5' spacing). In 1946 the two closer spacings were bearing their first crop on shoots from the 1943 stumping only, while the 5'×5' spacing was bearing on old wood as well as on shoots resulting from the 1943 stumping. Present indications are that with the 3'×3' stumping treatment the young suckers are "whippy" but this feature disappears at the wider (5'×5') spacing. The number of trees per plot varies from 18 (in the 10'×10' spacing) to 200 (in the 3'×3' spacing) but total yields do not differ to any great extent. Weeding costs are however much higher at the wide spacings. *Hemileia* is usually present in the closer spacing treatments.

(c) 1941 SHADE AND MULCH (NON-REPLICATED) TRIAL
YIELDS IN CWTs. OF FRESH CHERRY PER ACRE

1946			Total to date
Shade and Mulch ..	<i>Cordia</i> ..	55.85	110.80
	<i>Croton</i> ..	26.59	52.85
	<i>Ficus</i> ..	38.55	63.69
	Totals ..	120.99	227.34
	Means ..	40.33	75.78
Shade and no Mulch ..	<i>Cordia</i> ..	37.65	126.10
	<i>Croton</i> ..	12.91	75.95
	<i>Ficus</i> ..	31.01	95.22
	Totals ..	81.57	297.27
	Means ..	27.19	99.09
Mulch and no Shade ..	A. ..	83.20	129.93
	B. ..	66.25	117.38
	C. ..	53.53	85.43
	Totals ..	202.98	332.74
	Means ..	67.66	110.91

Excluding the mulch factor, the mean total yields, in lbs., of fresh cherry per plot of each shade treatment are :—

		Lbs.
No shade ..	..	1,735
<i>Cordia</i> shade ..	..	1,854½
<i>Croton</i> shade ..	..	1,007½
<i>Ficus</i> shade ..	..	1,233½

Cordia remains the best share both as regards the yield and appearance of the coffee under it. The improvement of the coffee under *Croton* shade, reported last year, has not been maintained and it is clear that this tree is unsuitable for shade purposes under Bugusege conditions. The *Ficus* is the big leaf variety which appears to produce far too dense a shade.

(d) MISCELLANEOUS

An observation trial, started in 1945, to see if it is possible to allow weeds to grow in the autumn and slash them for mulch at the beginning of the dry season without harming the coffee trees is continuing. There are indications that weeds require 2½ months growth to produce sufficient material for mulching purposes in January which brings the optimum time for allowing weeds to grow to mid-October; the coffee does not appear to be adversely affected.

A small sample of Sudan coffee sent for commercial examination and report, particularly as regards size of beans, indicated that this variety was "slightly below the usual size expected from Bugishu".

A further basket fermentation test was carried out at Bugusege and a commercial valuation obtained: the results are similar to the previous years findings, namely, that under Bugusege conditions fermenting for 12 hours is superior to any longer period up to 72 hours and the value of the coffee decreases in proportion to each succeeding 12 hours of fermentation.

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REPORT ON MINOR EXPERIMENTAL WORK

1. Coffee Arabica

Observation plots were maintained at numerous centres in the Western and Northern Provinces to study the effect of various types of shade on coffee. In one case, the shade treatments are superimposed on twelve varieties of coffee and the effect of manuring with kraal manure is also being examined. Yield results are inconclusive in respect of shade, although in general the various shade treatments have maintained the coffee in better condition than without shade. A marked although variable response to manuring was observable and this tended to be greater on unshaded plots.

The high altitude observation plots at Kachwekano in Kigezi District (6,500 feet), have become infested so heavily with *Antestia* that no crop has been picked for two years.

2. Coffee Robusta

The shade and mulch observation plots at Bulindi farm in Bunyoro were maintained and yields over the past five years indicate that *Ficus* spp. shade is superior to banana shade. Mulching with grass under shade has produced higher yields than no mulching but the reverse is the case on the unshaded plots. Similar observation plots in the West Nile District, but comparing Kents Arabica and Nganda Robusta, have suffered from excessive banana growth and results are inconclusive. Mulching observation plots in the lowlands of the West Nile District have produced no yield since 1941 and it would appear that this area is unsuitable for Robusta.

In Bunyoro, demonstration plots of Nganda and Robusta coffee, shaded and unshaded, were maintained.

The shade and ground treatment experiment at Bukalasa was maintained according to plan. Following on last season's heavy crop, yields were low. Analysed treatment yields are not yet available. Yields on the shade observation plots at this station were also of a low order this season and very variable, but on the whole were in favour of the shade treatments. These observation plots comprise simple unreplicated comparisons of Robusta and Nganda coffee grown without shade and under the shade of *Ficus* spp., naturally established *Acacia* spp., and *Leucaena glauca*. The Robusta is spaced at 10' × 10' square planting and the Nganda at 15' × 15' diagonal planting to allow for the greater spread of this type of coffee. Total yields for the period 1937 to 1947 are:—

YIELDS IN LBS. OF WET CHERRY PER PLOT

Treatment			Robusta	Nganda
No shade	..	..	20,155	9,137
<i>Ficus</i>	..	..	19,367	8,604
Natural (<i>Acacia</i> spp.)	..	..	16,328	5,182
<i>Leucaena glauca</i>	..	..	14,211	9,180

The lead given to no shade by last season's heavy crop was maintained, as yields for this year although in favour of shade, were too low to reduce this lead to any marked extent. It should be noted that the differences between Robusta and Nganda types on these plots, although large, are not necessarily significantly in favour of Robusta. In addition to the fact that Nganda is considerably later in reaching full bearing than is Robusta, the Nganda plots were pruned in the early years on a modified multiple stem system which has since been found unsuitable for this type of coffee as it slows up the normal development of the trees and extends still further the period required to reach maturity.

3. Tobacco

A variety and spacing trial of nicotine tobacco was conducted at Kachwekano Farm in Kigezi. The spacing treatments were inconclusive, but two varieties, Olsen 68 and Brasilia were considerably superior to all other varieties in yield of leaf. The nicotine content of these varieties, however, is low and compares unfavourably with that of the local variety now in production.

4. Cinchona

Plots of *cinchona* were maintained at Kachwekano and Kyembogo Farms on which growth and quinine content observations have been made by the Cinchona Research Organisation, in relation to variety, spacing and method of cultivation. The Cinchona Research Organisation has now ceased and these plots have been put on a care and maintenance basis.

5. Oilseeds

(a) GROUNDNUTS

Variety comparison trials were conducted at numerous centres in all Provinces. Yields are recorded in the tables accompanying this report. Sowing date trials, following up work at Serere which showed that over a period of years, March planting gave higher yields than later planting, were continued at three centres in the Eastern Province. Results over the past two years have not been in accordance with the Serere findings, however, and the trials are being continued to investigate the matter further. In Busoga District, a sandwich trial comparing the variety B 227 with the local variety gave a mean yield of 1,283 lbs. of unshelled nuts per acre with the former, as compared with 1,033 lbs. for the local variety.

(b) LINSEED

A preliminary trial was planted in the West Nile District. The crop was a partial failure and only 80 lbs. of linseed per acre were produced.

(c) SUNFLOWER

Observation plots of white and black seeded sunflower were planted in the West Nile District. Yields averaged 574 lbs. per acre for the white seeded and 480 lbs. per acre for the black. Better results were obtained in the Western Province, average yields of 1,000 lbs. per acre for black seeded sunflower being recorded on trials in Ankole

District. In Toro and Kigezi Districts, bird damage was heavy and yields were poor.

6. Beans and Peas

Trials of numerous varieties were made and yields are summarised in the accompanying tables.

7. Cereals

(a) ELEUSINE MILLET

Variety trials were conducted in all Provinces. In addition, comparisons of five variety mixtures were made at three centres in the Northern Province, using Serere and Ngetta mixtures each made up of five local varieties. There were no appreciable differences in yields.

(b) SETARIA ITALICA

Small observation plots in Acholi District gave yields ranging from 436 lbs. to 1,089 lbs. per acre. In West Nile District, yields were negligible on account of bird damage. Yields in Teso and Mbale Districts were of a higher order, reaching 1,408 lbs., and 1,685 lbs., per acre respectively. There is little demand for this grain as a food and as good yields are dependent largely upon freedom from bird damage, it is not likely to be taken up generally by growers.

(c) BULRUSH MILLET

Trials were confined to Teso and Mbale Districts. Yields generally were low, and in Mbale late plantings failed. Bird damage tends to be severe on this crop, but despite this it is becoming increasingly popular on account of the keen demand for it among the Asian community.

(d) SORGHUM MILLET

Trials of three varieties were made at Kakumiro.

(e) RICE

Observation plots of Sindano, Afaa, Sena, Kufuro and Bungalla varieties were grown in Ankole District, but the best yield was only 784 lbs. per acre of paddy from the first named variety.

In Mbale District, transplanted *versus* broadcast trials were made with two varieties under controlled water conditions. The advantage of transplanting was shown to be negligible and there were no appreciable differences in the yields of the two varieties.

Trials were conducted in Busoga District to compare the effect of controlled irrigation by bunding *versus* uncontrolled irrigation. The yields were not of a high order, but they supported the practice of controlling water by bunding as opposed to relying upon natural swamp flooding.

8. Cassava

Mosaic resistant strains derived from Serere and Kawanda continued to be increased for distribution at numerous centres in all districts.

9. Fertility Investigations—Bukalasa

(a) METHOD OF CROPPING OBSERVATION PLOTS—BLOCK G

These plots comprise six half-acre strips, on five of which different systems of cropping are under observation. The crop rotation used is the same on each strip and it is so designed that in any one season

the same crop is grown on all five strips. Direct comparison between crops is thus possible from time to time, but the investigation is primarily of a long term nature and until the strips have completed several cycles of cropping and resting, neither individual nor cumulative crop yields will have much value as indices of the effect of cropping methods on fertility. The sixth strip is a long term grass ley for permanent grazing.

Strips 1 and 2 were in their fourth year of cultivation and strips 3, 4 and 5 completed three years of resting and were cropped with sweet potatoes. Yields were :—

Strip No.	Method of Cropping						Lbs. per acre
1 ..	Continuous cultivation	..	..	..	..	..	7,615
2 ..	Continuous cultivation <i>plus</i> F.Y.M.	..	..	..	..	..	7,482
3 ..	3 years' cropping and 3 years' rest <i>plus</i> F.Y.M.	..	..	..	..	..	11,676
4 ..	3 years' cropping and 3 years' rest	..	..	..	..	..	13,658
5 ..	3 years' rest grazed and 3 years' cropping	..	..	..	..	..	12,393

(b) CONTINUOUS CULTIVATION OBSERVATION PLOTS—BLOCK E

Crop yields were the lowest recorded since 1929. Yields in lbs., per acre were :—

Season	Maize in Cob	Unshelled Groundnuts	Seed Cotton
1946-47	390	203	95
Means : 1928-1946 ..	1,399	860	489

The excessively wet weather during some periods of the year with consequent water-logging of the run-down soil of these plots was largely responsible for the exceptionally low yields.

The possibility of restoring soil structure on these plots is being investigated by using half of each plot for the establishment of vegetative covers. Kavirondo sorghum, *Chloris gayana*, *Setaria italica* and natural regeneration are being used. Sorghum established well and produced a good cover throughout the year. *Chloris* was slow to germinate, but later produced an excellent cover. Establishment of *Setaria* was patchy and it soon died out. Natural regeneration was normal.

(c) HOLDINGS C AND D

The two systems of farming on these holdings were maintained without change except for a reduction in the number of cattle on Holding D from six to four, as it was found that the resting land was unable to maintain the original number. On Holding C, however, six stall-fed cattle were maintained easily on forage cut from the same area of resting land, and it would appear that grazed elephant grass will not stand up to grazing by cattle to the same extent as it will from regular and controlled cutting.

Banana weevil damage continued to be heavy on the banana plots and a total of 32,524 weevils were caught in the trapping campaign.

TABLE I

WESTERN PROVINCE

TRIAL PLOT CROP YIELDS

Pounds per Acre

Trial Centre	PEAS					
	Dutch Marrowfat		Alderman		Harrison's Glory	
	Spring	Autumn	Spring	Autumn	Spring	Autumn
Kachwekano ..	1,500	588	633	924	675	756
Bulindi ..	659	..	446	..	303	..
Kyembogo ..	557	1,048	523	1,397	392	1,938
Ankole (2 centres) ..	..	..	316	993	443	747
Means ..	679	816	479	1,104	453	1,147

Trial Centre	BEANS		
	Abundance	Canadian Wonder	Black Bean
Kyembogo ..	3,033	1,506	1,216
Bulindi ..	1,612	566	..
Kachwekano ..	2,310	690	1,200
Ankole (5 centres) ..	1,384	..	432
Means ..	2,085	921	949

Trial Centre	SOYA BEANS				
	No. 63	No. 68	No. 184	No. 67	No. 69
Bulindi ..	163	588	893	827	240
Kyembogo ..	1,002	1,219	1,089	697	1,307
Ankole (6 centres) ..	829	688	862	845	845
Means ..	665	832	948	786	797

Trial Centre	GROUNDNUTS*			
	Local	Atuboi	B.239	B.227
Mbarara ..	1,460	1,547	1,395	1,220
Ibanda ..	2,071	2,180	2,834	1,046
Kibingo ..	1,068	545	893	..
Gayaza ..	1,867	323	1,255	564
Bulindi ..	2,057	2,407	2,784	1,508
Means ..	1,705	1,400	1,832	1,084

* Unshelled nuts.

NORTHERN PROVINCE

TRIAL PLOT CROP YIELDS

Pounds per Acre

Trial Centre	SOYA BEANS				
	No. 63	No. 184	No. 67	No. 68	No. 69
Arua	375	175	300	275	150
Nebbi	..	1,000	..	..	..
War	..	220	..	..	..
Aringo	..	74	..	..	..
Payida	..	385	..	..	..
Means ..	..	371	..	..	..

Trial Centre		Tepary Beans	Runner Beans
Kitgum	..	100	..
Arua	..	56	142
Nebbi	..	500	125
Payida	..	..	385
Means ..	..	219	217

Trial Centre	GROUNDNUTS*			
	Atuboi	B.239	B.227	"Busoga"
Lango (5 centres) ..	1,724	1,816	..	..
Ngetta	2,169	..	..	2,208
Gulu	566	871	645	..
Kitgum	1,028	2,392	880	..
Means ..	1,372	1,693	762	2,208

Trial Centre	ELEUSINE†			
	Serere Mixture	Ngetta Mixture	Engenyi	Odyera
Lango (3 centres) ..	2,030	1,926	..	..
Lango (2 centres) ..	..	..	2,157	2,023
Kitgum	1,626	2,090	2,070	1,849
Gulu	699	657	969	699
Means ..	1,452	1,558	1,732	1,524

* Unshelled nuts.

† Dried heads.

EASTERN PROVINCE

TRIAL PLOT CROP YIELDS

Pounds per Acre

Trial Centre	BEANS							
	Abundance		Haricot		Canadian Wonder		White Kidney	
	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Budaka ..	411	357	400	475	433	378	260	378
Bududa ..	113	790	120	314	85	242	65	560
Kuju ..	..	194	97	274	65	226	63	194
Katakwi ..	..	..	32	32	10	403	3	32
Bukedea ..	64	..	..	..	..	..	..	..
Nakabango ..	600	..	667	..	266	..	200	..
Nawanzu ..	526	..	672	..	367	..	263	..
Kibale ..	..	193	..	140	..	314	..	309
Kisoko ..	..	7	..	55	..	97	..	83
Means ..	343	308	331	215	206	277	142	259

Trial Centre		SOYA BEANS		
		Hernon 13	Hernon 29	Local
Nakabango ..	..	339	275	249
Nawanzu ..	..	720	990	1,000

Trial Centre		PEAS	
		Dutch Marrowfat	Harrison's Glory
Nakabango ..	..	917	883

Trial Centre		PULSES	
		Cowpeas	Black Gram
Kuju ..	..	307	452
Katakwi ..	..	89	104

BUGANDA PROVINCE

KAKUMIRO FARM—CROP YIELDS

Pounds per Acre

	Spring	Autumn		Spring	Autumn
SOYA BEANS—			ELEUSINE*—		
No. 67 ..	915	1,133	Emiroit ..	1,045	1,278
184 ..	958	741	Engomu ..	1,452	1,452
68 ..	436	523	Okwakoit ..	2,439	1,975
63 ..	653	436	Emeru ..	1,626	1,104
69 ..	348	..	Engenzi ..	1,975	2,207
			Local ..	929	1,801
SORGHUM*—			GROUNDNUTS†—		
Local ..	732	1,777	Local ..	1,513	478
Local II ..	2,927	2,195	Atuboi ..	1,815	956
L.I (Serere) ..	2,823	802	B.227 ..	1,210	629
POTATOES (<i>Solanum</i>)—			SESAME—		
Buta 1 ..	1,815	4,429	Kamod (Serere) ..	605	
Kakumiro 2 ..	4,901	6,552	Local 1 ..	454	
Kibale 3 ..	2,904	4,066	Local 2 ..	606	
Kyanasoke 4 ..	2,541	2,323	Local 3 ..	757	
				Tons	
			POTATOES (<i>Ipomoea</i>)—		
			Kawungezi	4.96	
			Magabali	3.12	
			Gafamulago	7.71	
			Namujuna	5.69	
			Kasoga	3.79	
			Kitikyambazi	5.96	

* Threshed grain.

† Unshelled nuts.

